

W I R E D 6.08
W W W I R E D. C O M

W I R E D

Fast Forward

August 1998

Poof!

There goes the desktop
computer.

Bill Joy, Jinius



Scott and Loraine are happily married,
with one little exception.

They never agree on anything.

He says "modern." She says "colonial." She likes regular. He wants extra-crispy.

So imagine the reaction when they announced it was time for a new car.

"Smooth and comfortable," said Loraine.

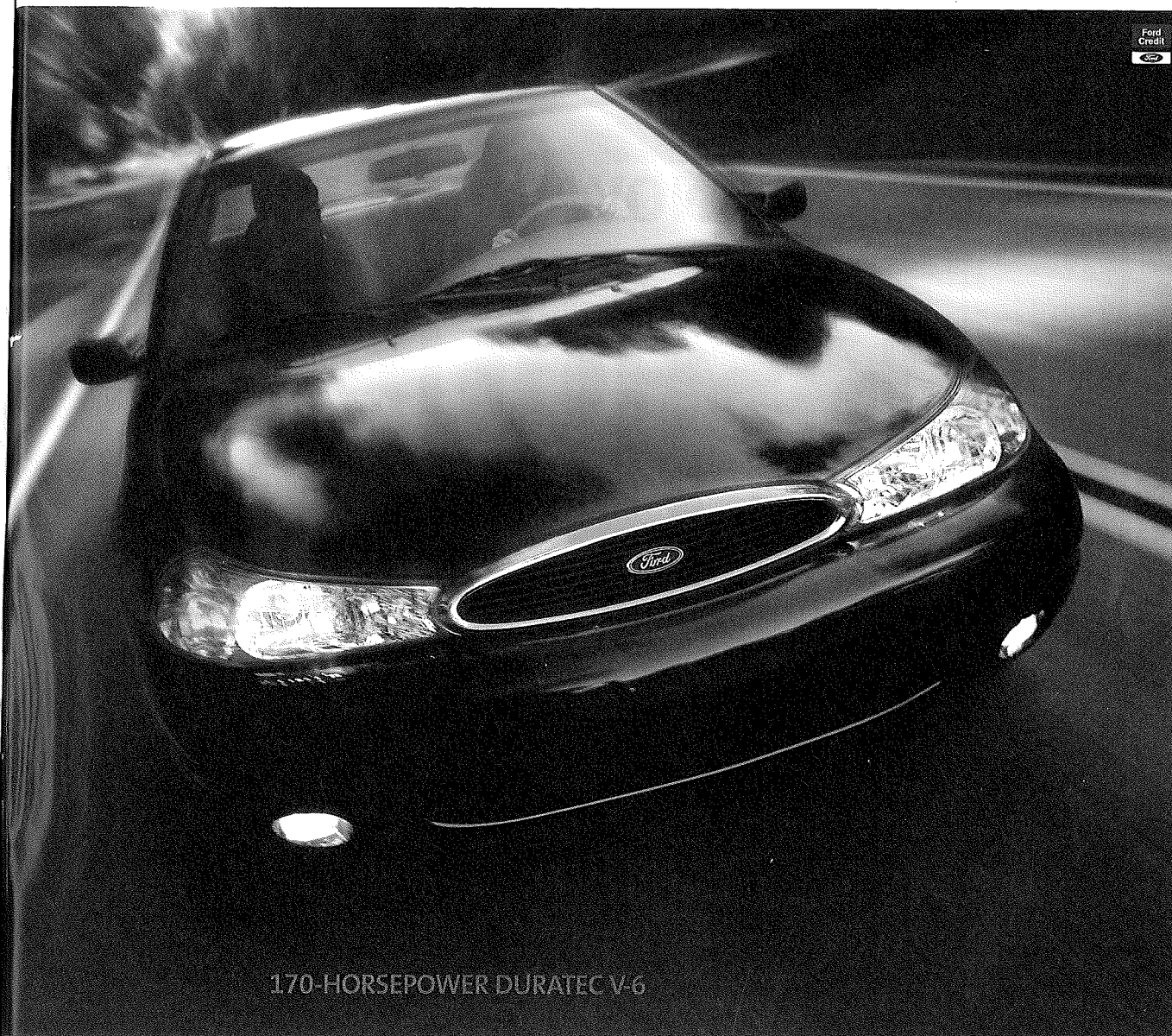
"A real driving machine," remarked Scott.

And when they arrived in a new Ford Contour SE Sport days later,

people were amazed. Finally, common ground.

Then they got up to leave. **"I'll drive,"** she said. Shaking his head

he replied, "I don't think so." Oh, well, here we go again.

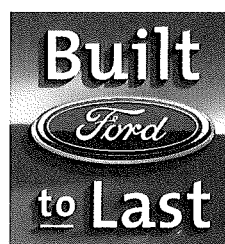


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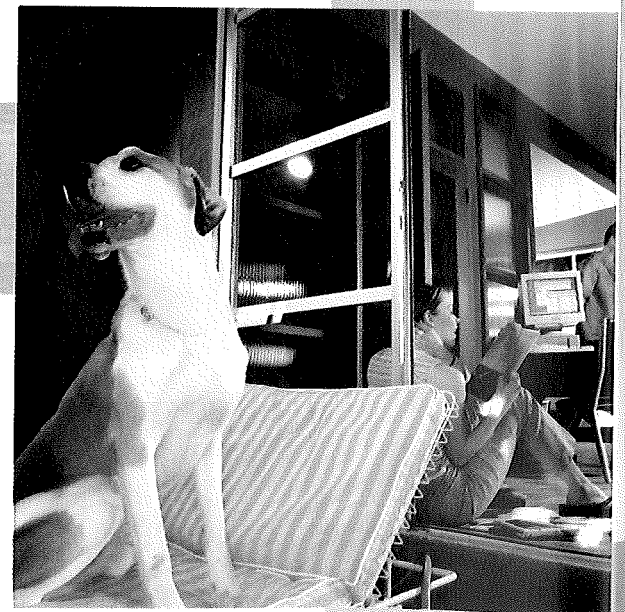


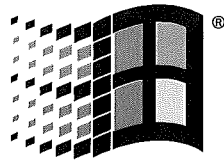
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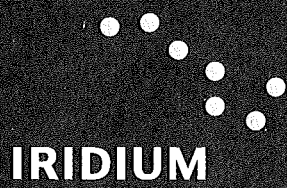
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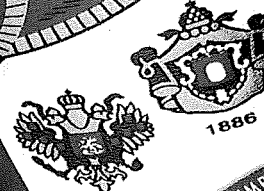
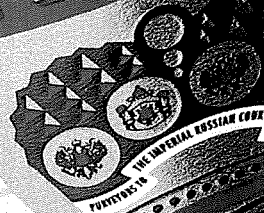


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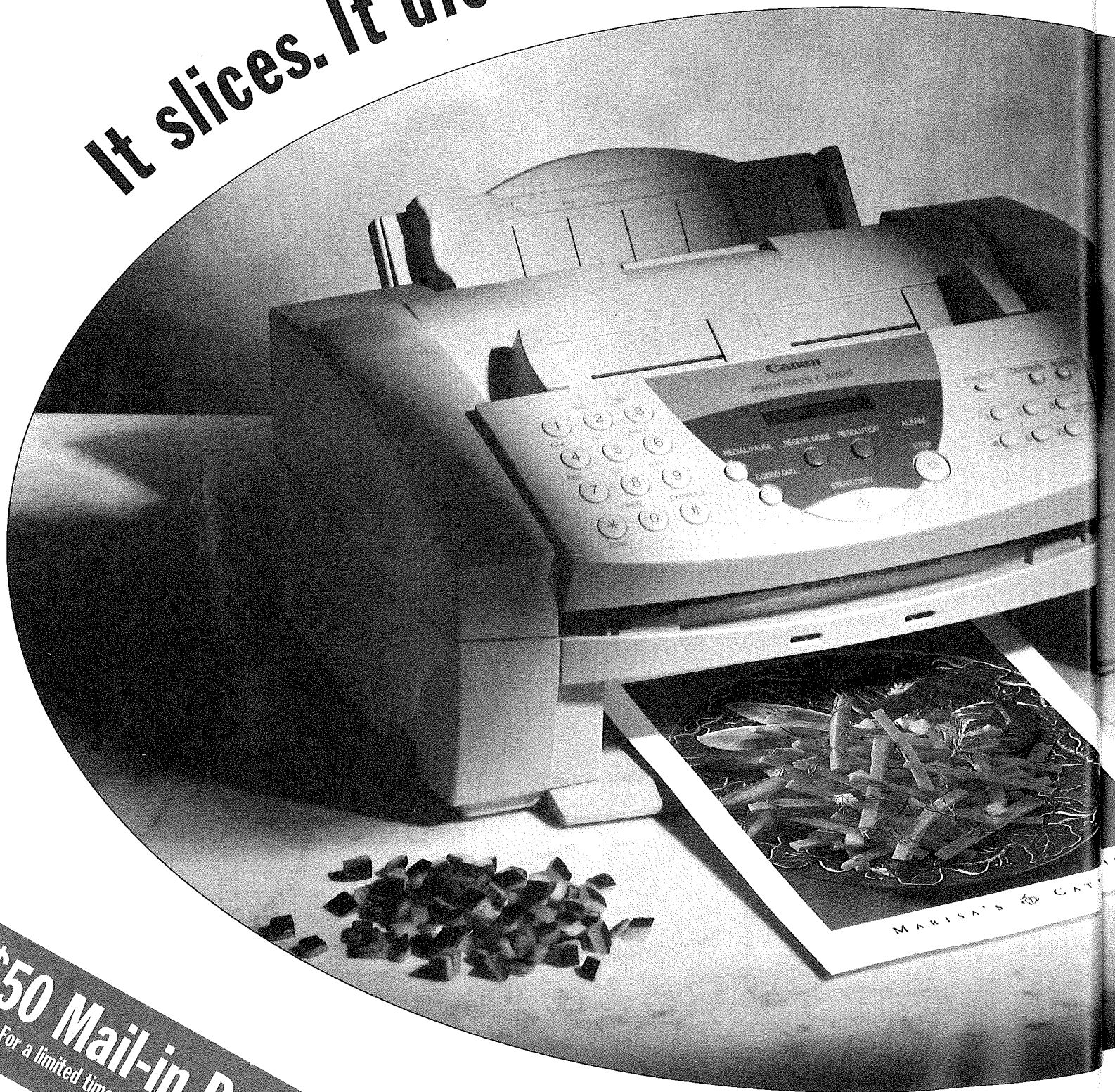


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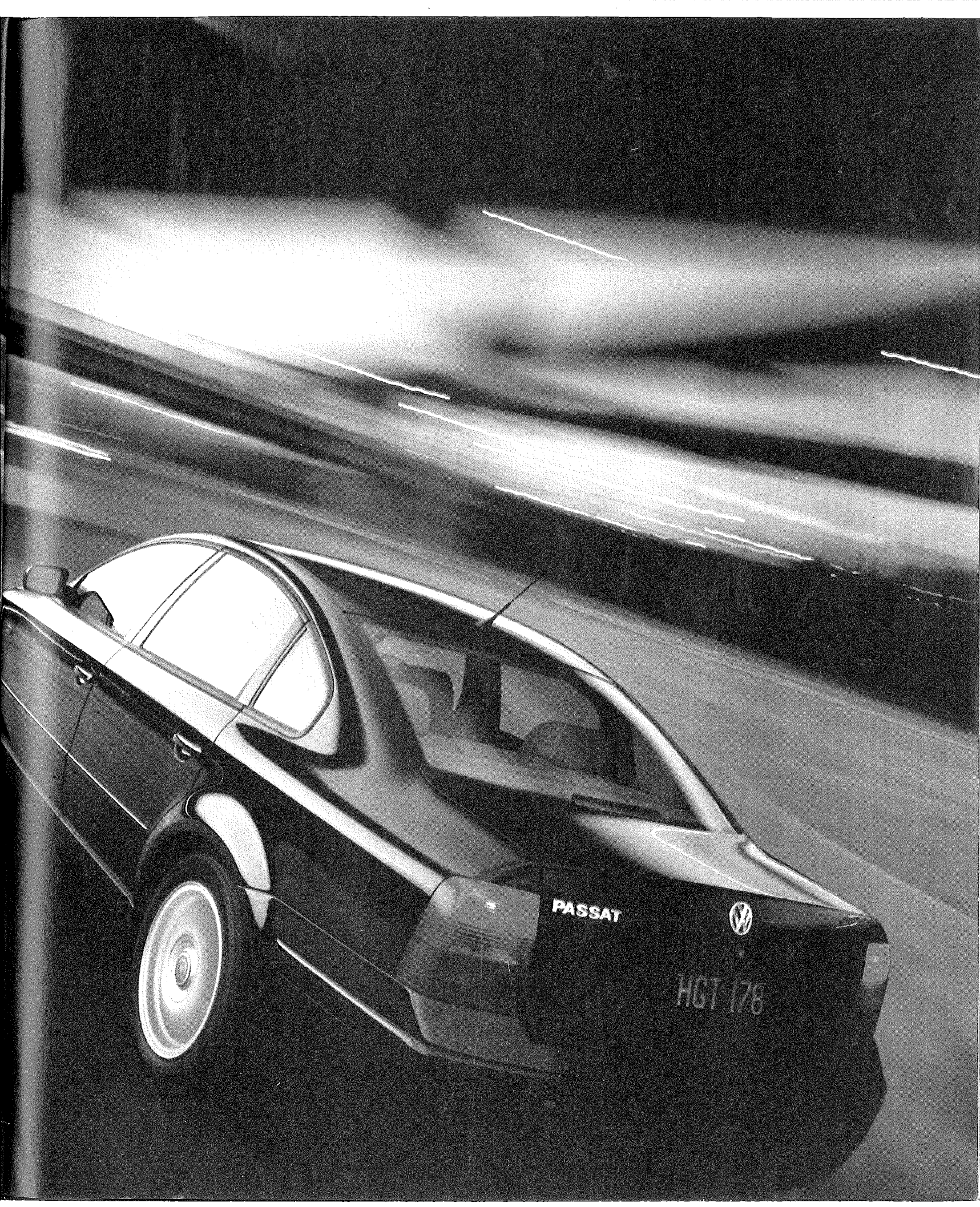
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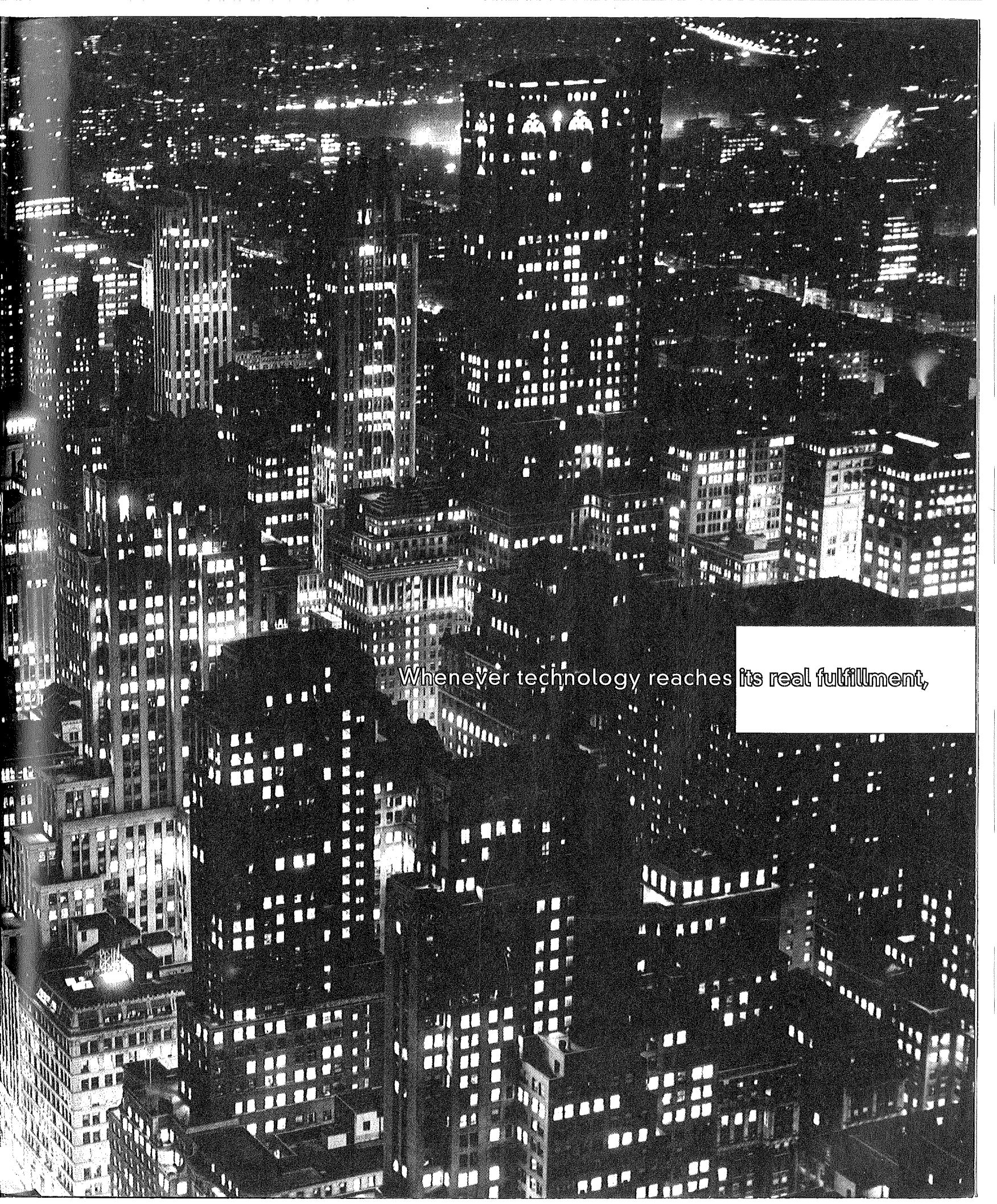


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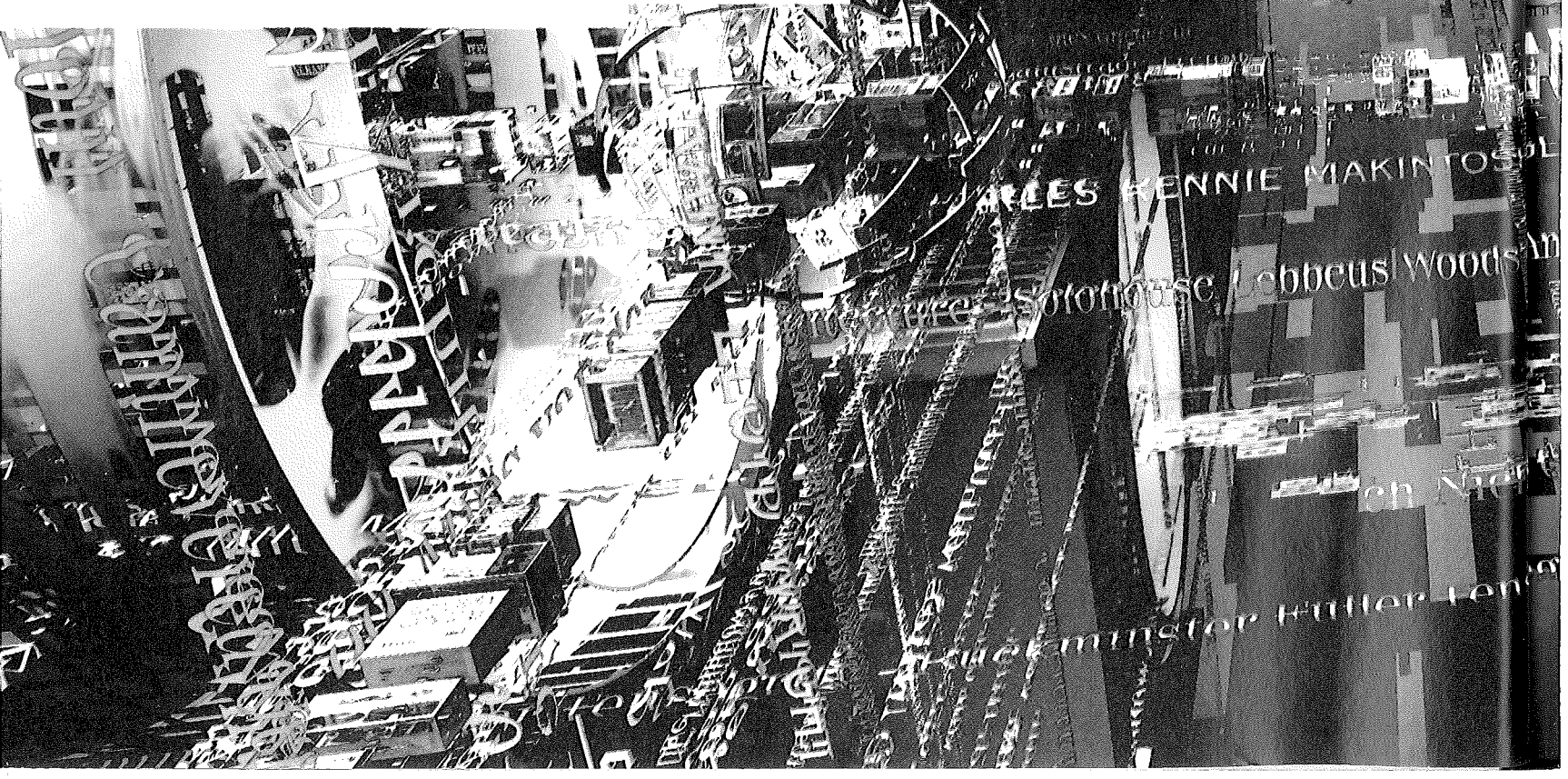


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It transcends into architecture.

– Ludwig Mies van der Rohe, in "Windows 99," page 110





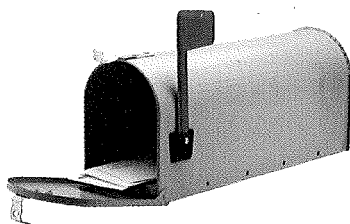
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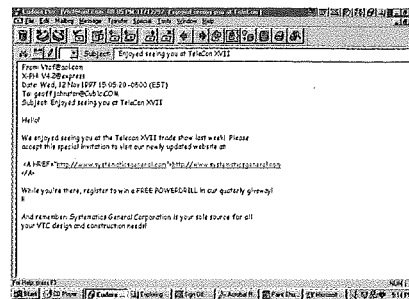
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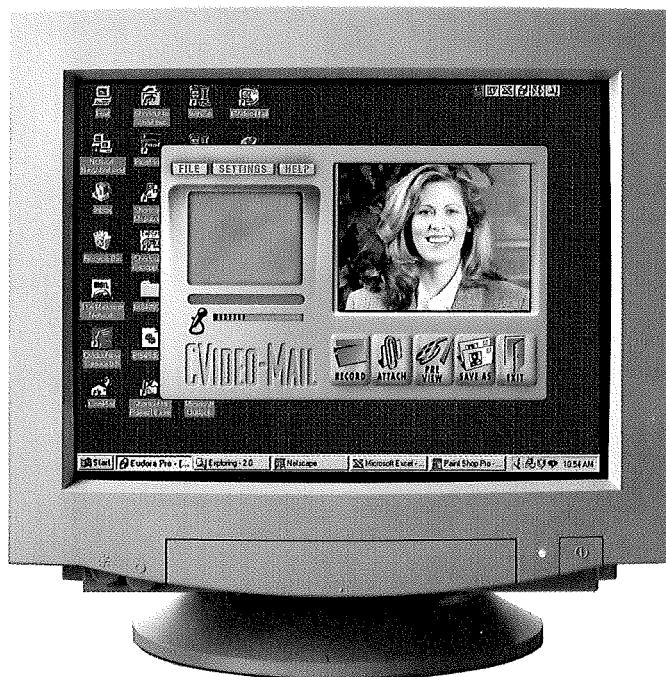


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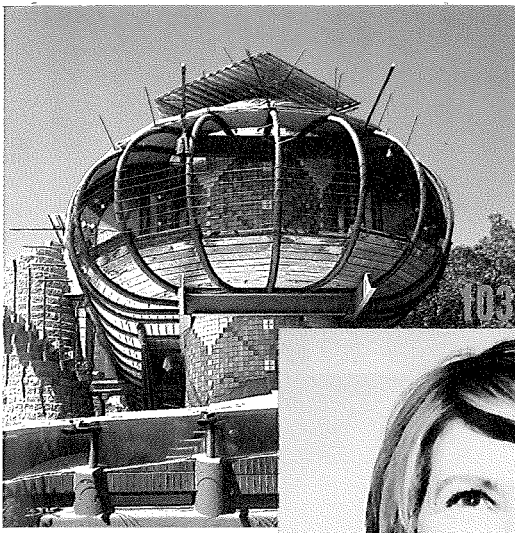
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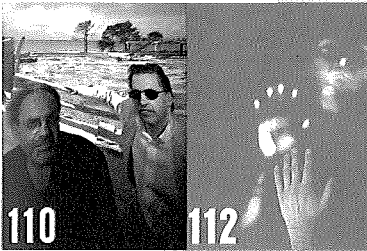


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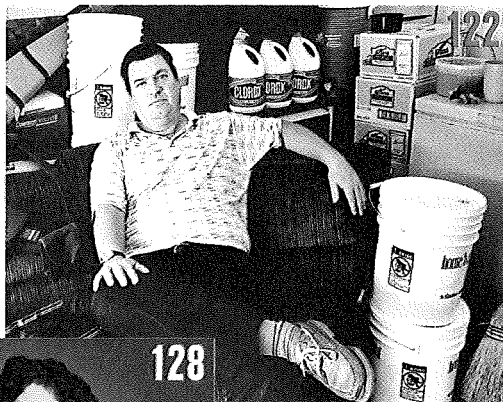


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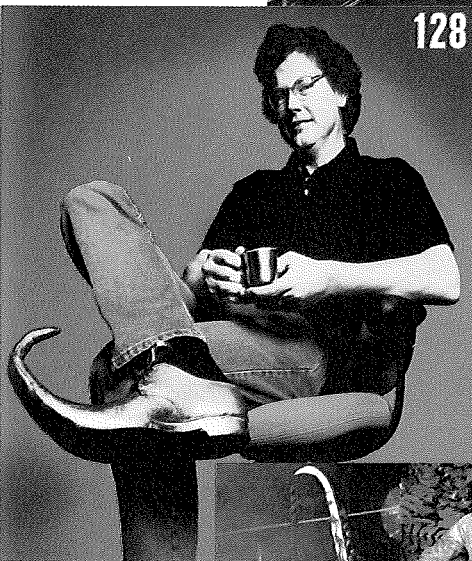
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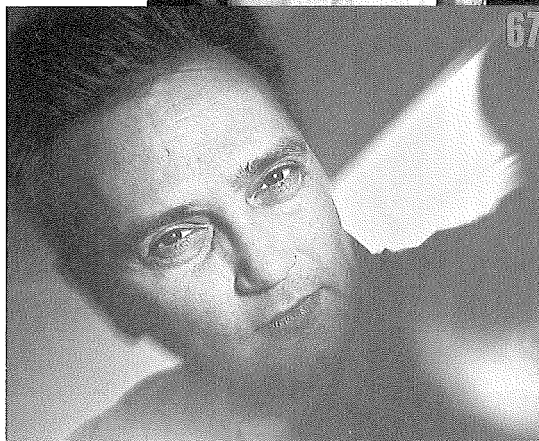
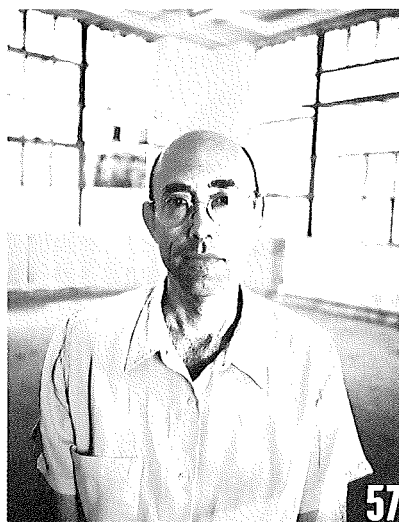
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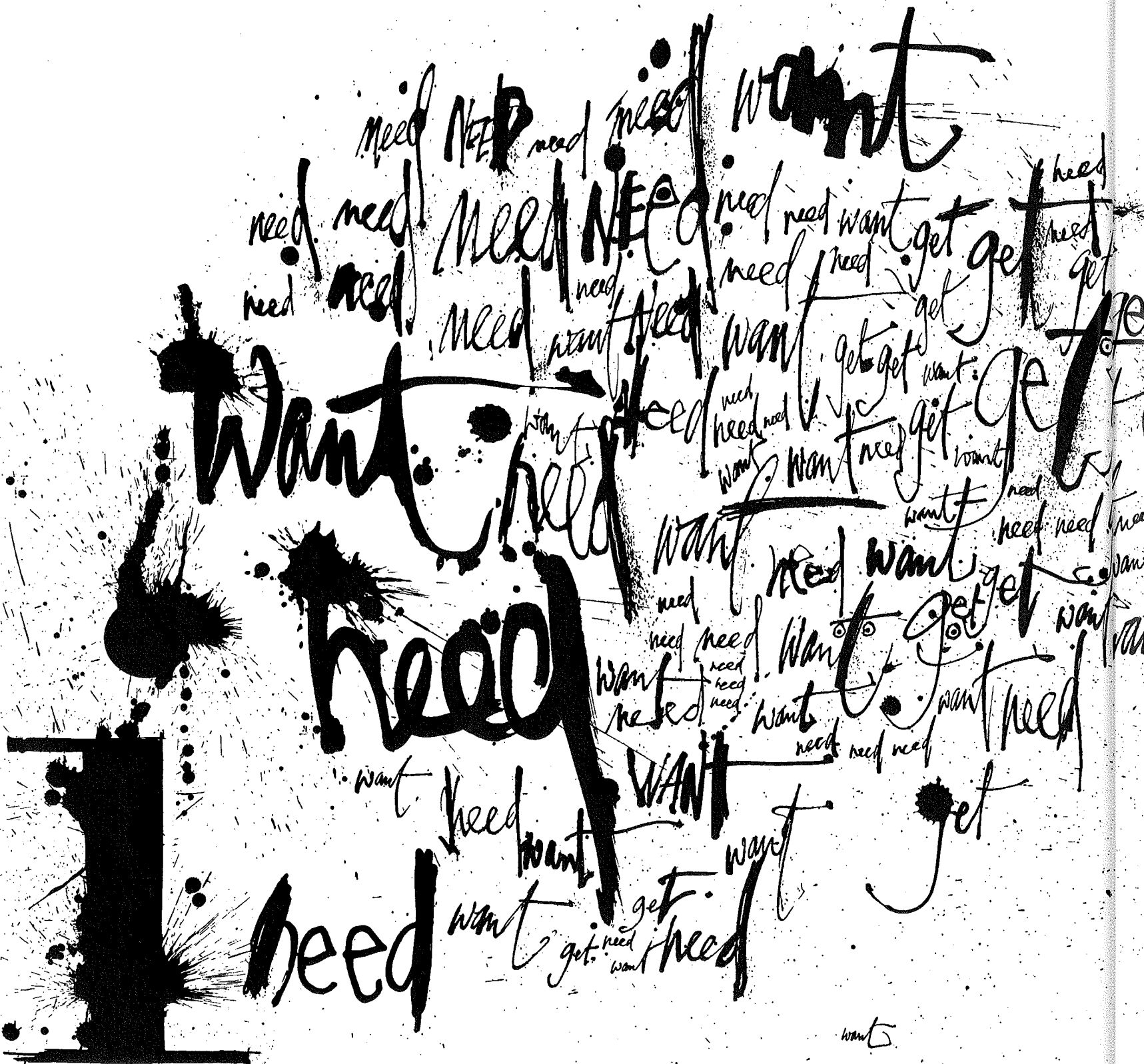
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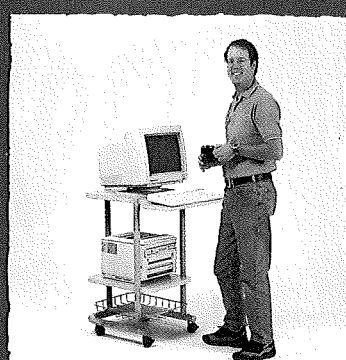
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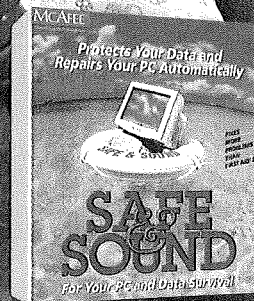
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Like Clockwork

At first I thought Danny Hillis's ego was out of control ("The Long Now," *Wired* 6.05, page 116). Then I began to empathize with him. The futurists be damned. They have no clue what technology will be like in 10,000 years, any more than those building the Univac I just 40 years ago could have envisioned me sending this over a phone line. The Bronze Age technologies used in the construction of the clock make it more contemporary and give it an organic feel. How do I sign up to crank it?

Chris Schott
chriss@iea.com

Open: Good

Closed: Bad?

The juxtaposition of two starkly different approaches to software development in *Wired* 6.05 – the barbarian-hordes approach of Eric Raymond ("Hacker-Philosopher," page 45) and the chosen-élite model utilized by Opera Software ("Norse Coders," page 49) – is nicely done. Despite the fact that both are receiving their 15 minutes of fame, it's unclear which – or whether either – will survive. What is clear is they can't both be right, and that has profound implications for Netscape, Opera Software, and Microsoft.

The open source model rests its hopes on the collective skill of thousands of developers working toward a shared goal. Opera Software, instead, has arrayed a few select, bright developers with the specific aim of building a better browser.

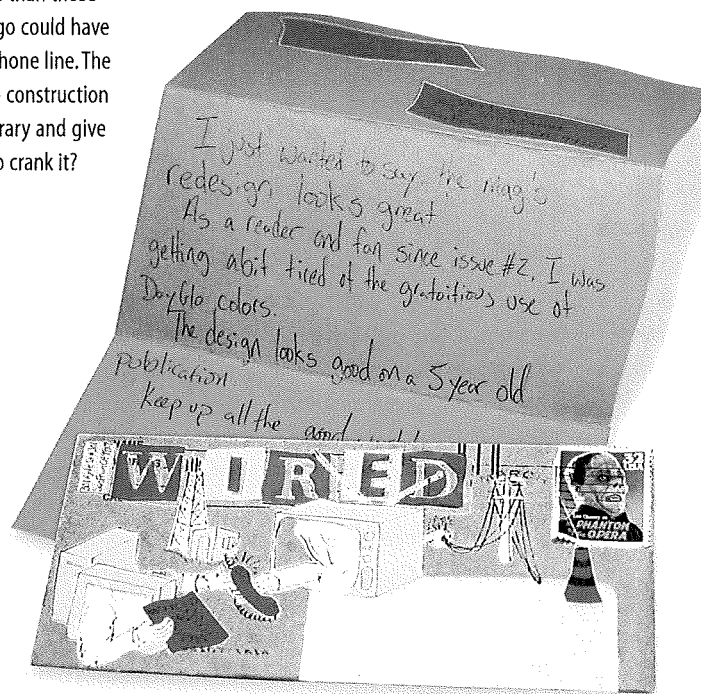
Software, in essence, is the embodiment of coordinated intelligence, the linking of minds to solve large problems. The process has two parts: harvesting from intelligent minds and linking disparate thoughts into a coherent whole. Netscape's model is predicated upon the belief that intelligence is the scarce resource; Opera's approach suggests that coordination is the problem. The battle should be interesting.

Brendan Dixon
bkdixon@gte.net

Big Time

The 10,000-year clock is a compelling idea, but I would like to raise the ante and propose a 1,000,000-year clock! In accordance with Hillis's specifications, the concept is simple and visual – not only an 8-year-old, but also a PhD can understand it. Recipe: Take a big hammer and pound a stake into the ground. Draw hour lines where the shadow falls according to the position of the sun. Maintenance: Dust it every 1,000 years. Et voilà!

George Kopeckzy
smooth@aloha.net



Keeping It Simple

Thanks for one of the few informative, nonhype pieces on the Net's role in our culture ("The Hot New Medium Is ... Email," *Wired* 6.04, page 104). The futuristic schlock written about the promise of all these bandwidth-hogging features tacked onto Web sites is both sickening and way off base. Efficient and simple solutions are the ones that thrive – email lists fit that bill.

Jake DeSantis
jake@alum.mit.com

Biological Tick

Danny Hillis is not going far enough in his search for a clock design. My father is struggling with multi-infarct dementia. He can tell if it's day or night, but it's not so obvious whether it's a.m. or p.m. Why is numeric or mechanical time relevant? There are many biological cues people can learn to recognize and appreciate. Why not use these as our construct for time? Light-sensitive organisms could establish time of day. Consider plants that open and close daily. Or roosters. Meetings would be much more interesting if we set rendezvous times this way: "Let's meet when the first robin egg hatches."

Rich Newman
rich@tagyerit.com

Building Better Lawyers

"The Hot New Medium Is ... Email" was an excellent article! I try to get the approximately 1,500 divorce lawyers on my list to communicate with each other, but, unfortunately, most lawyers, besides being technophobic, are too busy or just not inclined to interact.

However, this article has given me some great ideas, so hope springs eternal. Imagine: a future with kinder and gentler divorce lawyers!

Steven L. Fuchs
fuchs@divorcenet.com

All Things Being Unequal

In "New Economy? What New Economy?" (*Wired* 6.05, page 146), Paul Krugman predicts greater income equality, with "abstract symbolic work" becoming devalued and work that can't be automated — such as plumbing and gardening — increasing in value.

He is wrong on two counts. First, inequality of income within abstract symbolic work will *increase*. Even at the higher levels of knowledge work, little of what we do has not

been done before by someone else. But creating original material is still easier than looking for that perfect contract clause, ad copy, et cetera made by someone else. The Web will change this. As pattern-recognition software improves, it will become cheaper to find and appropriate what we need. So a few people will be superstars who earn a bundle, but they will leave little available work for others.

Re-Engineering Oldies

Forty years of wordmongering — I'm squeezing the last essence from my aging gray matter to comprehend the digital age — and I discover *Wired*. Bury my body but clone my brain — I want to catch up. It's too soon for me to praise the rantings and ravings of the brainiacs within your pages; their jargon is too often beyond my reach. But I'll salute what I instinctively recognize as meaningful communication. Given time in cyberspace and *Wired's* archives, I may yet join the debate. Watch out for "re-engineering oldies"!

Rod Pounsett

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Second, jobs that involve "contact with the physical world" are not likely to increase in numbers or pay. Even with a generous estimation of the number of semiskilled jobs not subject to automation yet still requiring some skills, he is talking about less than 20 percent of the labor force. Furthermore, there are unexpected ways of increasing productivity in such endeavors. Automating the ironing of clothes may well be difficult, yet wrinkle-resistant fabrics have reduced employment in this area; plastic pipe has reduced the skill level necessary for plumbing repairs.

Krugman's attempts to deflate the new economy should be put into context. As the mainstream economists add more epicycles to a dying paradigm, the fruitful thinking on major structural changes is coming from outsiders like yourselves.

Kit Sims Taylor

kitaylor@bcc.ctc.edu

Business as Usual

In "The Promise of One to One" (*Wired* 6.05, page 130), Donna Hoffman claims that consumers want a relationship with businesses over the Web. But I've never heard a consumer say, "I wish I had a relationship with my insurance company." Or supermarket, or bank, or whatever. It's *businesses* that want the relationship with *consumers*. Business is killing itself to build these "relationships," regardless of cost. It's invasive. It's pushy. And only in rare instances does it reveal lasting substance for the consumer.

Jack Dickerson

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CE: Curious Enigma

In "The Televisionspace Race" (*Wired* 6.04, page 148), Frank Rose comments on the ambiguous name Windows CE. He refers to it as "consumer electronics," and Craig Mundie denies any meaning whatsoever. I'm sure that when the product was first announced, it was dubbed Windows Compact Edition. Why this hasn't stuck is a mystery; maybe Windows CE didn't want to offend its big brother.

Jonathan Thaw

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Undo

Name-Calling: The name of the company acquired by WorldCom in 1996 ("Building the Future-Proof Telco," *Wired* 6.05, page 124) is MFS Communications. ■ Crossed Lines: Argentina's national telco was privatized in November 1990 ("The Deregulation Paradox," *Wired* 6.05, page 79); its two private monopolies now face deregulation. ■ One for the Book: *Phoenix: The Fall & Rise of Videogames* ("Videogame History 101," *Wired* 6.05, page 151) is published by Rolenta Press; more info can be found at www.atarihq.com/features/phoenix.html. ■ What He Said: Paul Saffo's comment on the Millennium Clock was erroneously attributed to Anonymous, and vice versa ("The Long Now," *Wired* 6.05, page 116).

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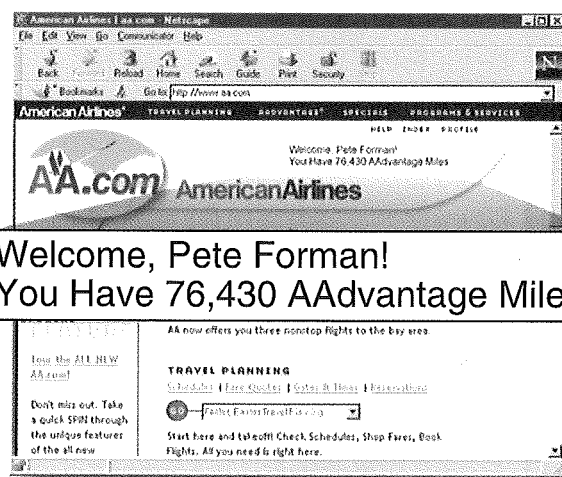
Editorial correspondence:
editor@wired.com



Growing up, I got good at taking direction.
"Say your line here." "Hit your mark there." And "Drink your milk."
That's good advice for kids and adults. The calcium in milk helps bones
grow till you're about 35 and helps keep them strong long after.
So I still drink milk. Only now, I'm the one giving direction.

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do you know
where your
current mileage
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Microsoftening

The Feds and 20 states filed suits against the software superpower, charging that integration of its Web browser into Windows 98 is an attempt to extend its OS monopoly. Despite its freedom-to-innovate spiel, **Redmond clearly felt the antitrust heat.** Witness its unwonted flexibility with Gateway, allowing the computer maker to offer Netscape as the default browser on new Win98-based PCs.

Wintel Woes, Part Two

Antitrust enforcers sued Intel for trying to squeeze trade secrets from would-be rivals. An overture to a wider action? The FTC is probing whether the chipmaker used its near monopoly in the PC market to force its way into new sectors. Also, **Intel delayed production of Merced** – its first 64-bit microprocessor – until mid-2000, forcing partner Hewlett-Packard to delay related systems.

Cracking India

A trio of **teen crackers penetrated India's Bhabha Atomic Research Centre** network and downloaded detailed files. Indian sources confirmed the intrusion, which was intended to protest the country's nuclear-weapons tests this spring. The teens' next declared target: Pakistan's weapons program.

Telecom Two-Step

MCI sold its Net business to Cable & Wireless for US\$625 million, hoping to assuage regulators who fear that its merger with WorldCom (which owns UUNet) would squash competition in the data-services sector. Analysts quickly pegged C&W as a takeover target – a sign that the Great Telecom Shuffle is far from over.

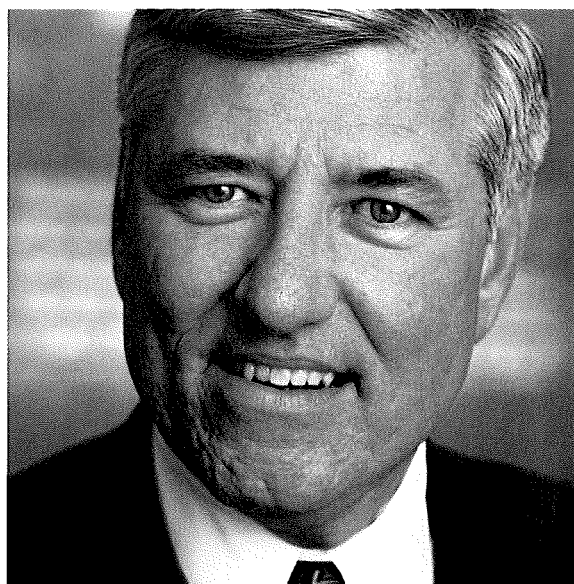
It's a Policy!

Hand out the cigars: The White House finally delivered its **restructured domain name system.** The plan defers tough decisions – competition and the creation of new generic top-level domains like .web – until a global nonprofit agency is in place. **The big winner: Network Solutions Inc.,** whose .com monopoly remains effectively intact.

Trivia Moment

NSI noodled with its DNS databases to produce these **coast-versus-coast trivia bits:** Of the 1.86 million .com, .org, and .net domain names, 9.5 percent are registered in the New York City metro area and 7.2 percent in Washington, DC. California cities trailed those eastern hubs in numbers, though the state boasts 5 of the top 10 Netliest cities.

Netliest Cities	%
1. New York	9.5
2. Washington, DC	7.2
3. LA/Long Beach	6.9
4. San Francisco	3.6
5. Boston	3.4
6. San Jose	2.9
7. San Diego	2.2
8. Dallas	2.2
9. Atlanta	2.1
10. Oakland	2.1
East Coast	West Coast



Chief exec Richard Brown is leading C&W into the telemerger spotlight.

Teary Moment

Jobs isn't talking, but **Apple's other founding Steve confirmed the tale** from Gil Amelio's pass-the-buck bio *On the Firing Line*: In pre-Apple days, Jobs cut a \$1,000 deal with Atari for a circuitboard that Wozniak designed and built. "Jobs came back and gave me \$300, saying that they had talked him down to \$600," quoth Woz. Years later, when Woz learned that Jobs had been paid in full and kept most of the take, he cried a bit. "But it didn't affect our friendship one iota," he averred.

Web Siphon

After scrutinizing 1,400 commercial Web sites, the Federal Trade Commission reported that 86 percent sucked in user data with little or no warning. Most troublesome, the agency said, was the percentage of children's **sites that surreptitiously collect data** – a practice that the FTC suggested Congress outlaw. Remarkably absent in the reaction: libertarians telling the Feds to keep their mitts off the Net.

Getting the Picture

Kodak and Intel joined forces to offer digital-imaging tools and services, suggesting that the historically go-it-alone photo giant understands that the new economy depends on strategic partnerships. The picture-perfect ending: a **Kodak/AOL deal.**

Speed

Sprint announced Project Fast-Break, a \$2 billion **plan to roll out high-speed voice and data service** to US homes and businesses. The technology: asynchronous transfer mode. The details devil: To serve small customers, Sprint must cut deals with potential rivals – the telcos that own local wires.

Indelible Inktomi

The search- and network-technology company **went public**, raising \$40 million in the first day, thanks in part to its new Yahoo! license.

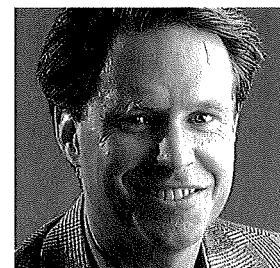
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Revenue Model

An elder of online news, the **Mercury Center stopped charging** for the daily Web edition of the *San Jose Mercury News* in a ploy to build the site's readership. So information really does want to be free – but only if it's the hard-to-sell general-interest variety, and only when there's an ad base to prop it up.

Search Term: Hubris

In a way-rude style, **Excite rejected a \$1.7 billion takeover** offer from Zapata, saying that the fish-oils manufacturer-cum-new media player "holds no possible value to Excite's shareholders." Ironic from a company that has never turned a profit and had to borrow \$50 million from partner Intuit to get on Netcenter.



Excite CEO George Bell ain't merging.

Pushing It

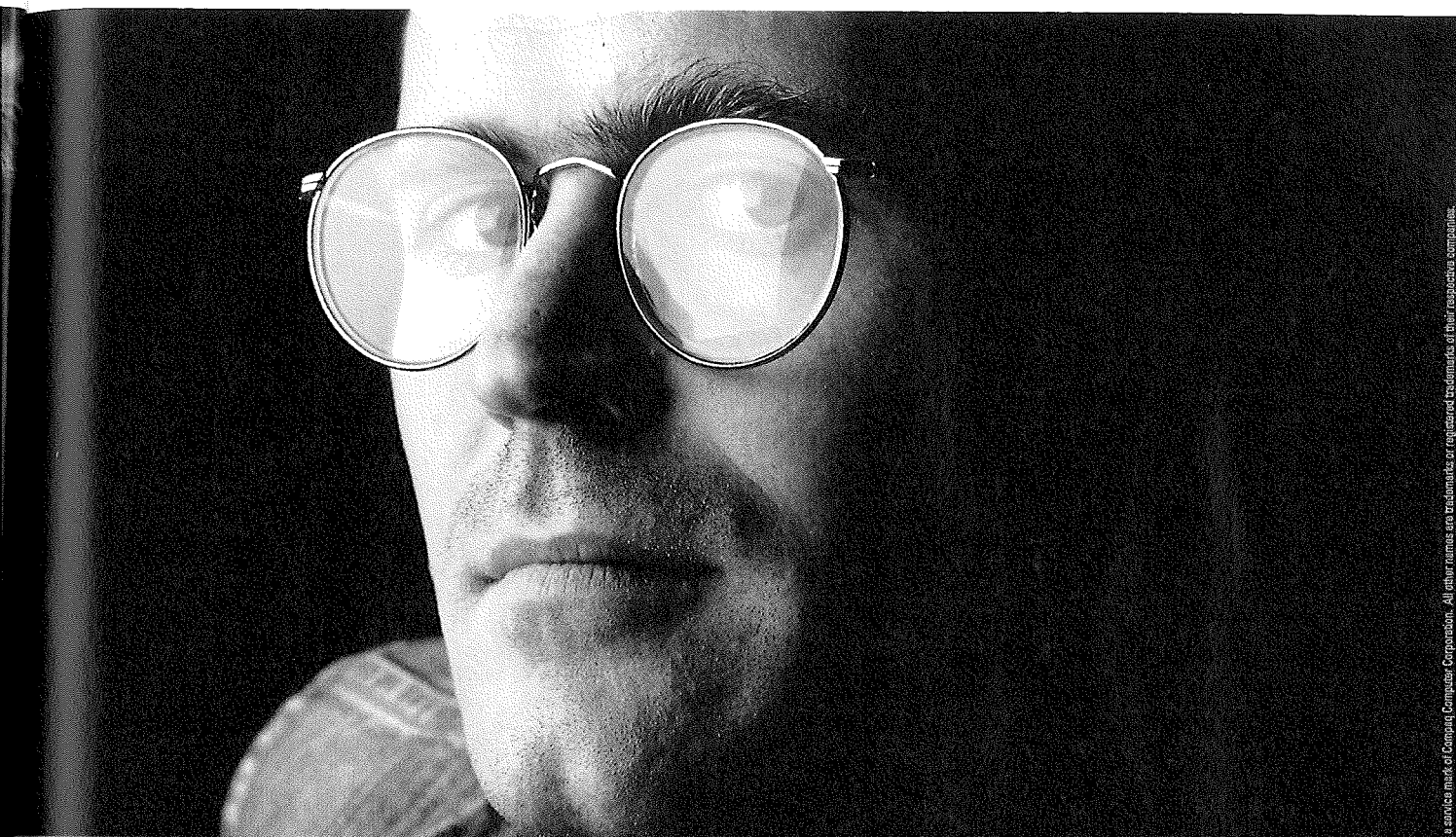
PointCast took the IPO plunge, filing papers that value the company at \$235 million. It's a far cry from the \$400 million News Corp. offered for the company last year. Fly in the IPO ointment: Conventional wisdom says portals, not push, will grab the biggest Web audience.



A whole new Compaq?
What's in it for me? And me?
And me? And me? And me?

COMPAQ

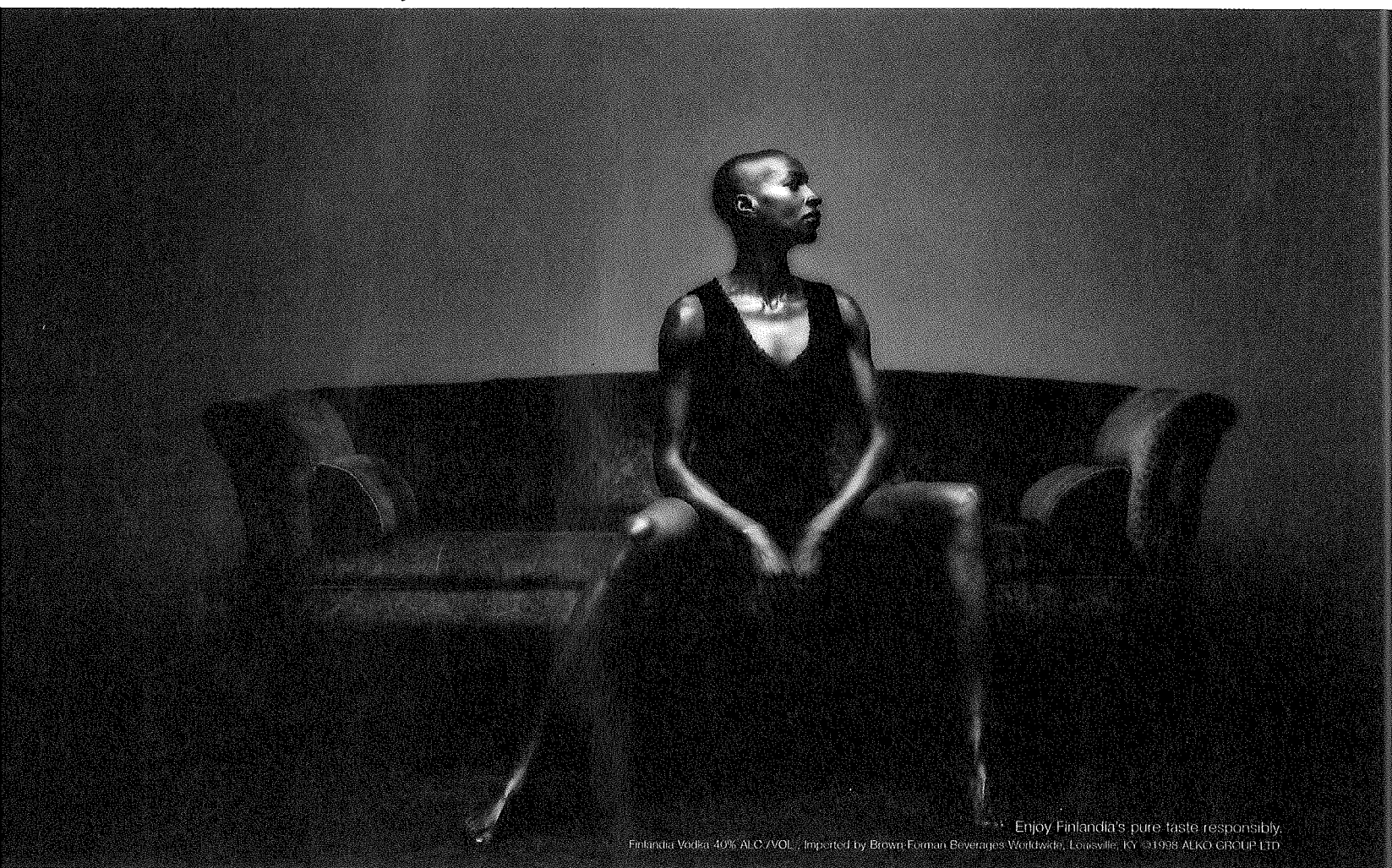
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In a past life I was an Egyptian Queen. I know how the pyramids were built and exactly what they mean. But I'm not talking.



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*In a past life I was pure,
glacial spring water.*



Net Juggernaut

"We know more about Net application development than Andersen Consulting, Deloitte & Touche, and IBM," boasts **Joe Firmage**, 27-year-old cofounder and CEO of USWeb. Bold statements aside, Firmage's growth strategy has proved difficult to resist: 32 webcos and 1,000 employees have been assimilated into USWeb since '95. Having turned heads with his Borg-like biz model, Firmage now stands accused of wanting to cash out. "The common perception is that any roll-up strategy is purely a financial play," he admits. "But this is a long-term bet."

Splicemeister

"Whole genome shotgun sequencing," declares **J. Craig Venter**, will shoot his venture past the government-sponsored Human Genome Project and decipher the human genetic code in a paltry three years. "It's the biological equivalent of Moore's Law." Venter, the president of the private-sector Institute for Genomic Research, is one of the few scientists who isn't shy about making grand predictions. When asked to assess the advantages of his brand of gene mapping, he says, "We're going to do the whole thing for US\$300 million instead of \$3 billion, and in three years instead of 15 – at no cost to the taxpayer."

Techno Muse

Fox Lorber is planning to distribute **Lynn Hershman-Leeson's** *Conceiving Ada*, a film homage to Lady Ada Lovelace. But Ada is only the latest in a long line of digital exploits: Almost 30 years ago, Hershman-Leeson made *Lorna*, the first interactive laserdisc art piece. Recently, her photo series *Cyborgs* showed in San Francisco and Berlin. And now she's busy crafting dolls with networked surveillance cams for eyes. "Duchamp said that all anyone can expect is three good ideas," says Hershman-Leeson. "I've had only one: People can change the utopian or dystopian force of technology by infusing it with poetry." Next, she plans to direct two poetic films about "the ethics of artificial life."

Agenda Setter

"At the FCC, I was one of 2,000 staff people – most of whom were lawyers," says former FCC counsel **Kevin Werbach**, who recently swapped his legal briefs for the managing editor gig at *Release 1.0*. One of the few policy wonks who really got it, Werbach must now give it back – in the form of analysis – via Esther Dyson's exclusive newsletter. "My job used to be convincing companies not to run out of the room screaming when I told them I was from the government," he jokes. "Now I have tons of start-ups beating down my door."

Storyteller

Before *Myst*, **Jordan Mechner** set the standard for elegant adventure games with his 1989 classic *Prince of Persia*. Mechner's creations, like the Miller brothers' work, eschew body count for story line, and his fans seem excited that he has agreed to help craft *Prince of Persia 3D*. But the interactive aficionado seems to be steering his narrative prowess in another direction: He's wrapping up a movie script based on the train mystery *The Last Express*. "Programming once seemed like the hardest activity ever," he says. "But now I think screenwriting is harder."



IRON MINT!

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ELECTRIC WORD

Doom with dinosaurs? Seamus Blackley, the designer of *Trespasser*, DreamWorks Interactive's new *Jurassic Park*-based game, has something else in mind – consistent reality, an internal logic based on natural laws rather than coded responses. Physics, the former PhD student believes, is more immersive than flashy effects.

In testing, Blackley tried to walk a character over a barrel, but, like a circus bear, it began moving backward as the barrel rolled beneath its feet. "I never thought of that, and I wrote the system," he beams. "It's the idea of emergent properties. When the game does something you didn't expect, something that would occur in the real world, that is cool." – Tom Chick

Emergent Designer



IMAGE: SÉRGIO BELINCHON

Eyeballing the Sky



Like a round round moon, the new planetarium in Valencia, Spain, captivates. Designed by Santiago Calatrava, the Spanish architect celebrated for

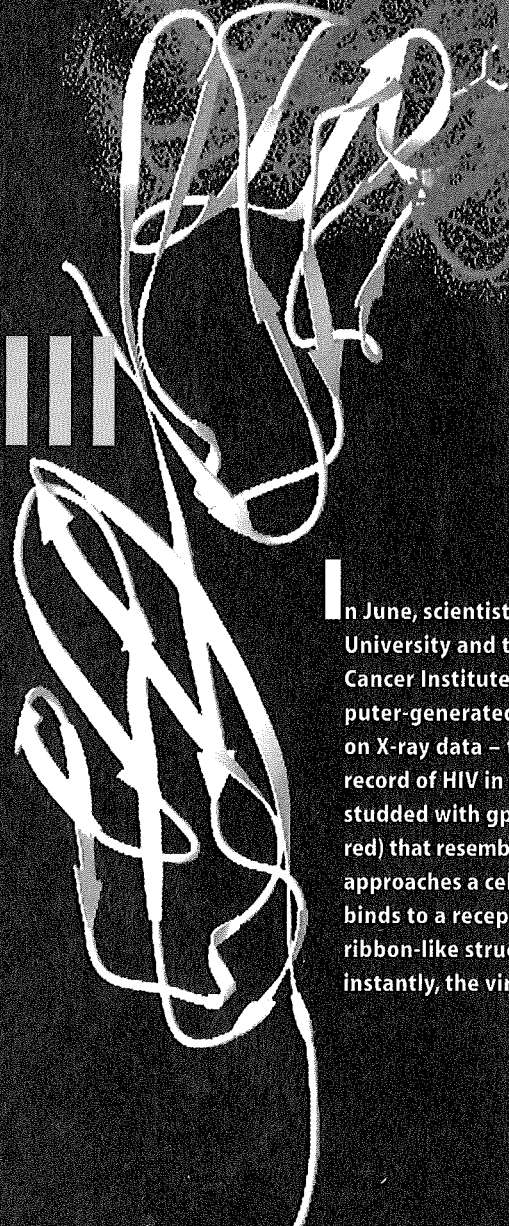
his implausible bridges and buildings, the Hemisfèric opened in May. In the overall design, form follows function, or at least celebrates it. The canopy

ball, protected by a partially open steel and glass shell, suggests a watchful eye. The theater, in the lower globe screens in a

films in addition to celestial laser shows. An adjacent science museum and art wing—also Calatrava—will open next



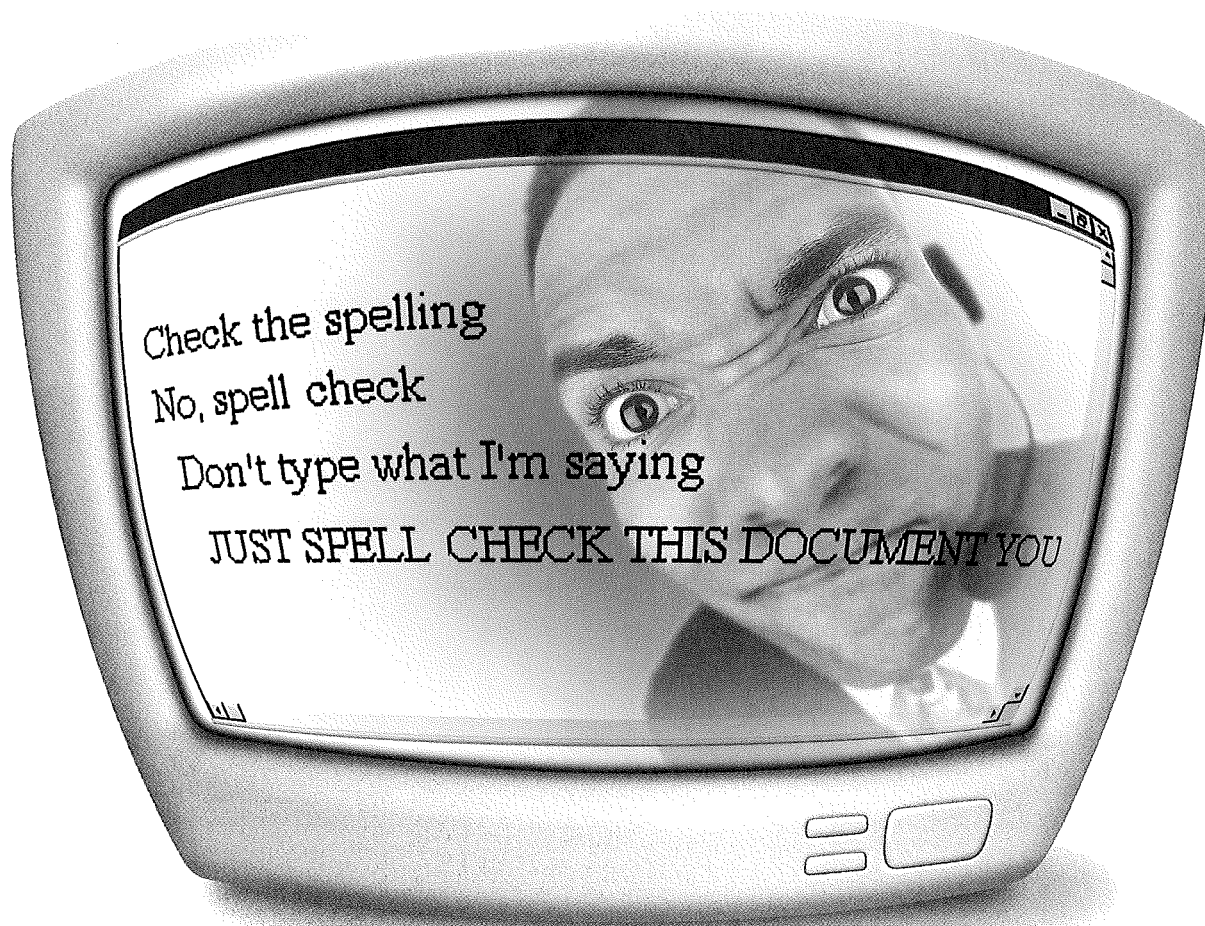
Deadly Embrace



In June, scientists at Columbia University and the Dana-Farber Cancer Institute released computer-generated images based on X-ray data – the first visual record of HIV in action. The virus, studded with gp120 proteins (in red) that resemble the body's own, approaches a cell undetected and binds to a receptor (the yellow ribbon-like structure). Almost instantly, the virus attaches to a

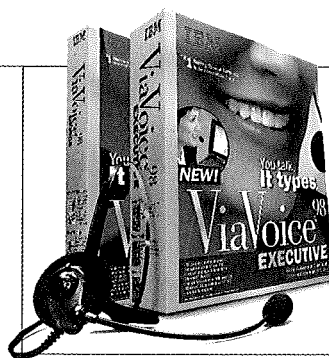
second receptor, pulling the cell into a deadly embrace. In this image, the second attack is intercepted by the 17b antibody (in blue), present in only a very small percentage of the population. "HIV is uncanny and unprecedented in its insidiousness," says Columbia biochemist Wayne Hendrickson. "This detailed information of the structure and the process of infection is what we need to design a vaccine." – *Jessie Scanlon*

IMAGE: WAYNE HENDRICKSON AND PETER KWONG



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Bad Will Hunting

Max Cohen – thirtyish, balding, underfed, and a mathematical genius – spends his days and nights locked in his roach-motel apartment, trying obsessively to crack the numerical code that describes, alternately, the essence of the natural world, the fluctuations of the stock market, and the name of God. This is the story of π , the darkly idiosyncratic debut film by Darren Aronofsky (right) starring Sean Gullette (left), opening this summer at an art house near you.

Shot in eerie, high-contrast black-and-white, π recalls another worthy, if weird, first feature: David Lynch's *Eraserhead*. Dubbed *Anti Good Will Hunting* at Sundance, π won the festival's directing award. It has also won the attention of Hollywood hitters like Ridley Scott, who wants Aronofsky to direct his next project. – Steve Bodow

Book of Revelation

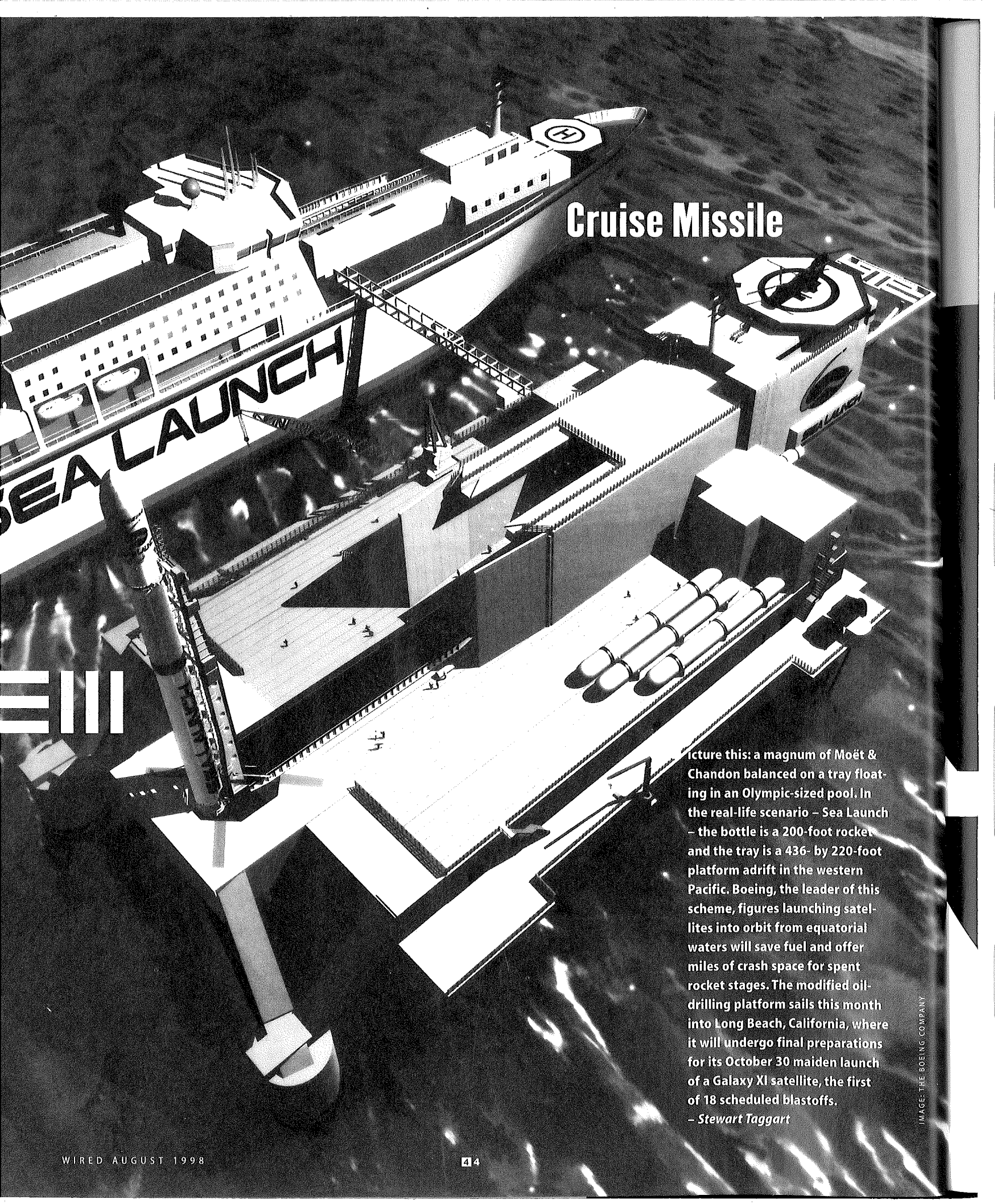


In June, Phil Patton returned to Area 51 – a place where close encounters outnumber luncheon counters by a good thousand-to-one margin – to participate in a protest march outside the covert base deep in the

Nevada desert. Patton (bottom), who first visited the place for *Wired* in '93, knows all the theories on secret activities inside. His new book, *Dreamland: Travels Inside the Secret World of Roswell and Area 51*, reveals, among other things, the

truth behind Ike's visit to the legendary Aurora project, but it's really a cultural history of secrecy in America. "Information and disinformation," says Patton, "are antimatter and matter when it comes to Area 51."

– Randall Rothenberg



Cruise Missile

EM

Picture this: a magnum of Moët & Chandon balanced on a tray floating in an Olympic-sized pool. In the real-life scenario – Sea Launch – the bottle is a 200-foot rocket and the tray is a 436- by 220-foot platform adrift in the western Pacific. Boeing, the leader of this scheme, figures launching satellites into orbit from equatorial waters will save fuel and offer miles of crash space for spent rocket stages. The modified oil-drilling platform sails this month into Long Beach, California, where it will undergo final preparations for its October 30 maiden launch of a Galaxy XI satellite, the first of 18 scheduled blastoffs.

– Stewart Taggart

IMAGE: THE BOEING COMPANY

Direct contact.

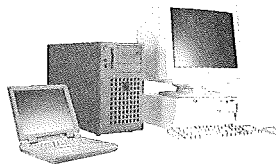
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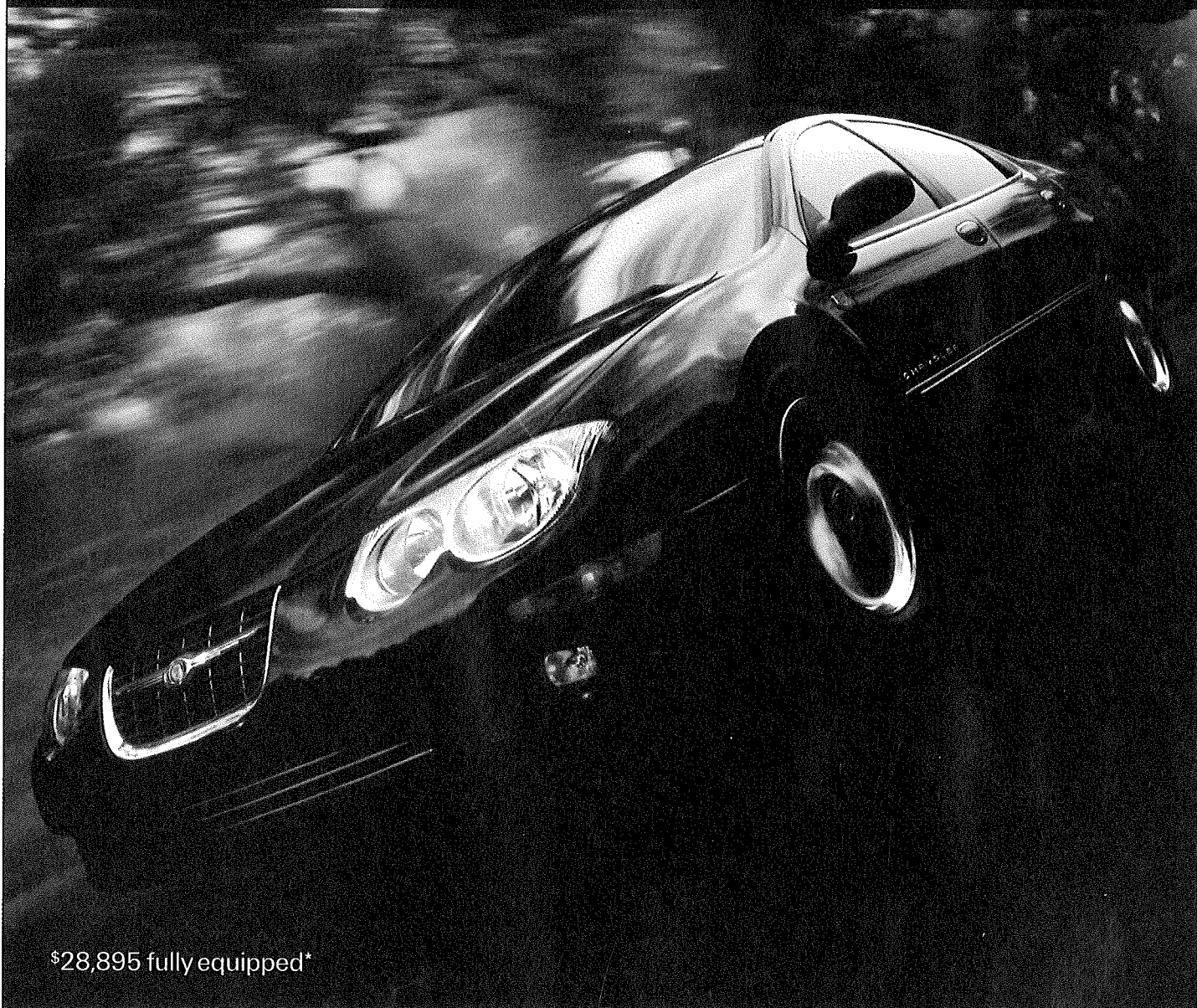
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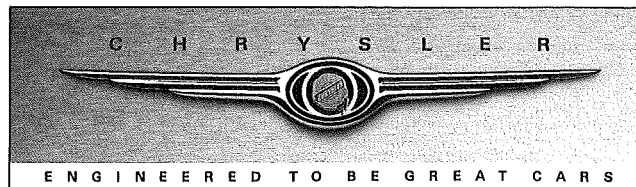
The All New Chrysler 300M

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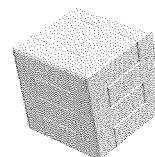
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FETISH



By Bob Parks

Infinitely Wearable

A glorified watch this is not. Powered by a 16-bit processor, the Ruputer Pro serves up a triple threat: This souped-up chronograph is also a full-featured PDA and a game unit. Sure, it keeps time, but this Win95-linkable device, flush with 2 megs of flash memory, also has the organizer functions of a Palm-Pilot. And its infrared communication with other Ruputers may soon allow for the sort of head-to-head gaming 3Com junkies can only dream about. The hitch: The Ruputer is sold exclusively in Japan. Ruputer Pro: ¥48,000 (US\$360). Seiko Instruments: on the Web at www.seiko.com/Ruputer.html.

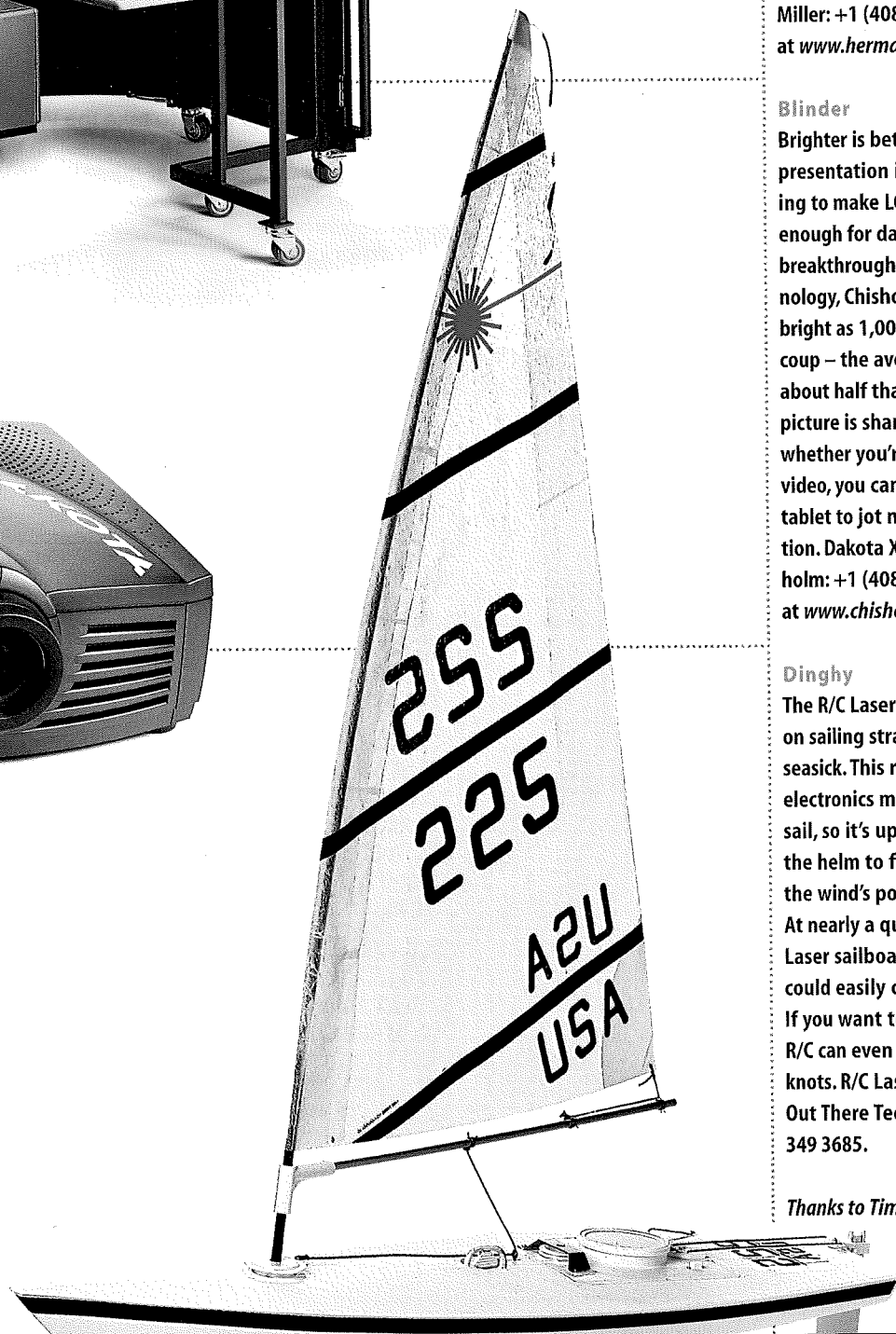
Sure Shot

Remember what you did when the goons in *Doom* were after you with a chaingun? Well, it's probably a good idea to flee the business end of Porter-Cable's cordless nailgun, too: The Bammer can sink nails through 2.5 inches of oak as quickly as you can squeeze the trigger. The first nailer with an oil-free internal-combustion engine, the Bammer uses a volatile gas propellant, allowing about 3,000 shots per fuel cell. Bammer: US\$299. Porter-Cable: (800) 487 8665, on the Web at www.porter-cable.com/.

Universal Access

While the world waits for Motorola's grand fleet of low-earth-orbit satellites, Magellan has already perfected mobile communication via email. The Global Satellite Communicator – the first handheld worldwide messenger – uses 28 LEOs to let you receive and store up to 100 messages, as well as send notes of up to 2,000 characters. Though the unit costs less than Iridium's proposed model, it's a good idea to learn shorthand: Sending text costs around a penny per character. GSC 100: US\$999. Magellan: +1 (909) 394 5000.





Roadhouse

It's no wonder that the US armed forces are looking at Herman Miller's portable office cube as an option for quick deployment. Originally built for visiting consultants, the Puzzle Mobile Workstation can easily be shipped anywhere and unfolds to provide a large desk area complete with a power strip for your laptop. This workspace also has a filing cabinet, overhead light, and porous walls suitable for tacking up urgent documents or pet photos. And, when you're out of the office, the box can be locked up for privacy. Puzzle Mobile Workstation: US\$6,948. Herman Miller: +1 (408) 727 9517, on the Web at www.hermanmiller.com/.

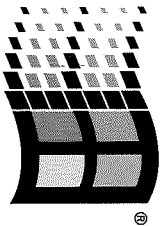
Blinder

Brighter is better. For some time, the presentation industry has been trying to make LCD projectors luminous enough for daylight rooms. With a recent breakthrough in reflective LCD technology, Chisholm's Dakota burns as bright as 1,000 ANSI lumens (quite a coup – the average package produces about half that many). The Dakota's picture is sharp – 1,024 by 768 – and whether you're projecting from PC or video, you can use the Dakota's PenPal tablet to jot notes onto the presentation. Dakota X1000: US\$13,995. Chisholm: +1 (408) 559 1111, on the Web at www.chisholm.com/.

Dinghy

The R/C Laser sailboat lets you work on sailing strategy without getting seasick. This radio-controlled boat's electronics move the rudder and the sail, so it's up to the landlubber at the helm to figure out how to use the wind's power to best advantage. At nearly a quarter the size of a real Laser sailboat, this 41.5-inch craft could easily carry your Chihuahua. If you want to sail rougher seas, the R/C can even essay winds up to 30 knots. R/C Laser sailboat: US\$399.95. Out There Technologies: +1 (718) 349 3685.

Thanks to Tim Dickinson.



Works better. Plays better.

98

WINDOWS[®] 98

THINKS

THE

INTERNET

SHOULD LOOSEN UP

AND LIVE

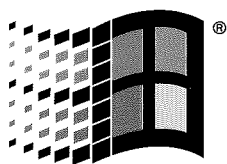
A LITTLE

Where do you want to go today?

Microsoft[®]

www.microsoft.com/windows98/internet/

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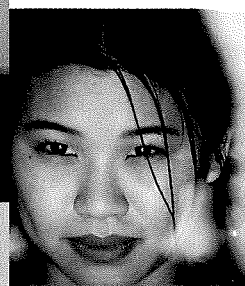


All these partners' products and Windows 98 let you do more on the Internet. Check them out.

Works better. Plays better.

98

The Internet. A good idea but it should be easier. It should be faster. It should let you do more of the stuff you wanted the Internet for in the first place. In other words, **THIS**



Take your best shot and share it with the world using *Kodak PhotoNet Online* and the *DVC323 Digital Video Camera*. Check out our Kodak Picture Spot on the Web. Fun and Prizes. Take Pictures. Further.™



The Logitech .cam™ Internet Video Camera: Snap stills. Shoot video. E-mail them anywhere. Or make live video calls. It's so simple even the microphone is built in!

3Com U.S. Robotics

Experience the Internet like never before with our 56K* Faxmodem! Compatible with V.90 standard and x2™ technology. World's #1 selling modem.

*Capable of receiving at up to 56 Kbps and sending at up to 31.2 Kbps. Actual speeds may vary.



WaveTop

WaveTop—it's fast, *free* and easy. Just add a TV card to your PC. Get the best of the Net. No phone line, no ISP, no waiting.



An APC uninterruptible power supply means uninterrupted fun. Buy APC Back-UPS Pro® for *legendary reliability* and complete peace of mind. Never Stop.™



QuickCam® VC is the most popular, easy-to-use PC camera for videoconferencing with family and friends over the Internet.



The SupraExpress™ and the SupraSonic™ II modems now support the 56K standard. They also include *Shotgun™ technology* for modem speeds to 112K!



The Zip® drive and genuine 100 MB Zip® disks let you download and save all kinds of stuff from the Internet.



THE WHOLE WEB THING SHOULD JUST BE MORE FUN.

And, with Microsoft® Windows® 98 and these great partners, you're well on the way. Hmm, suddenly the Internet is looking like a pretty good time.

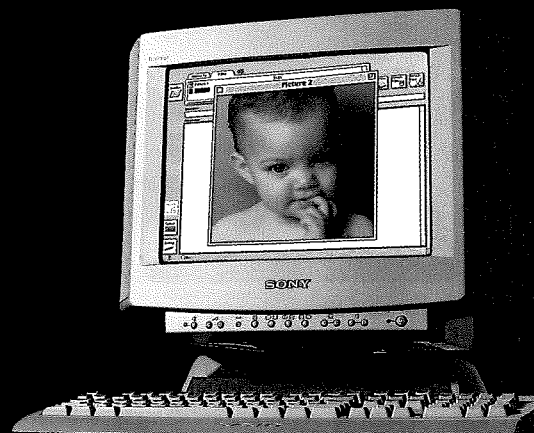
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your post office.



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to store images on a standard floppy disk.***

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as easy as putting a floppy into your computer.
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adapters to use, and no wires or cables to
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IMAGE: JAY BLAKESBERG

Internet tel



Rocket Launchers

With backing from Paul Allen, Res Rocket is growing from a low-key Web jamming club into a global music destination.

For MIDI musicians who jam online, there's only one place to go: Res Rocket (www.resrocket.com/). In the three years since its launch, the site has evolved from a low-key club for real-time collaboration to a global community of 14,000 musicians, including professionals such as Dave Stewart of Eurythmics fame, a member of The Orb, and Ninja Tune producer Matt Black. Now, with backing from Paul Allen's Vulcan Ventures, the San Francisco-based shop is looking to go big time.

As the only dedicated jamming network, Res Rocket offers a free public-access area to amateur musicians worldwide. Using the site's software

and improvisational skill, a blues pianist in Chicago, a bass player in Greece, and a drum programmer in London can play together live, 24 hours a day. For busy, geographically challenged professionals, Res Rocket has become a choice destination to record CD-quality sounds. Bands and commercial production teams lay MIDI tracks in the site's private recording areas, which rent for US\$500 a year.

Founders (from left) Canton Becker and Matt Moller were Northwestern University grad students and Willy Henshall and Tim Bran were "shameless, mainstream" UK pop musicians when the partners met through email. "Our first connection was musical,"

CEO Henshall recalls. "We blew a pair of speakers, bought a leased line, and were off." British investors and sponsorships first kept the company afloat.

This summer, Warner Bros. is distributing Res Rocket's greatest-jams CD, a collection of online sessions. The site plans to upgrade to digital audio by early 1999 and integrate its technology with Vulcan companies, including the Experience Music Project museum, opening in Seattle next year.

"We're investing our resources into digital audio so that the system works for everybody – guitarists, singers, didgeridoo players," Henshall says. "Res Rocket is a musical framework where things happen." – *Colin Berry*

The Voyager Returns

MULTIMEDIA SOFTWARE



As founder of The Voyager Company, Bob Stein (left) helped publish some of the most critically lauded CD-ROMs, including Laurie Anderson's *Puppet Motel* and Art Spiegelman's *Maus*. Creative genius and business acumen don't always mix, however (see "The Teachings of Bob Stein," *Wired* 4.07, page 126), and in 1997 the partners liquidated the 13-year-old shop.

Stein is back with Night Kitchen (www.nightkitchen.com/) and a plan to tap what he sees as a large pool of potential multimedia creators attracted to computers but repelled by the lack of artist-friendly tools. He's building TK3, an "authoring tool for the rest of us."

"At Voyager," he says, "we were always subordinating content to the

tools. Tools are a really big deal." TK3 (for tool kit 3), scheduled for 1999 release, is an easy-to-use yet powerful program for creating documents, presentations, and other interactive works. But TK3, unlike programming-intensive tools such as Director, requires no scripting.

Stein is hitting the growing PC multimedia market on the upswing. Even so, Quark recently discontinued mTropolis authoring software in the face of competition from entrenched players.

Eric Swenson, production head at Hearst New Media Center, thinks the tool has a shot at success. "TK3 just feels better than any other authoring environment," he says. "It's way better than fucking PowerPoint."

— Stephen Jacobs

ADVERTISING

We Interrupt This Call ...

Having registered a worldwide patent for its system of free phone service that inserts advertising messages into calls, Swedish telecom GratisTel International is now heading overseas.

The system, in use by 100,000-plus Swedes alone, allows users to place free calls by dialing a phone number and a GratisTel code. A 10-second ad plays before the call is put through, then another to both parties after one minute and at two-minute intervals. A beep signals impending commercial breaks.

Since individuals must fill out a questionnaire to use the service, advertisers get not only captive audiences, but also demographic data. GratisTel's system can't be used for free online access, but it does allow international and cellular calls.

Flush with the success of recent licensing deals in Norway, Spain, Italy, Australia, New Zealand, and the Philippines, ongoing negotiations with 20 other countries, and a spanking-new US base, GratisTel is weighing a public offering. — Stephen Shipside

CG ENTERTAINMENT

Synergy on the Silver Screen

In the realm of digital entertainment, aesthetics often plays second fiddle to commercial concerns. But with help from the likes of cult filmmaker David Lynch and game maestro Haruhiko Shono, Tokyo-based Synergy Inc. is walking the high-res line between art and profit.

In spring 1999 the company will debut its first computer-generated feature film, *Underworld*, by Shono, creator of the top-selling CD-ROM epic *Gadget*. But whereas *Gadget* was a long, strange trip on a train, *Underworld* dives to the bottom of the ocean, where an archaeologist discovers a hidden city at war.

"*Underworld* is based on ideas quite different from those of *Gadget*," says Shono, a former video performance artist. "Nevertheless, you'll probably feel some similarity of mood in the atmospheres."

Synergy's dark side has attracted David Lynch, who is scheduled to release his first new media effort, the *Woodcutters From Fiery Ships* CD-ROM, in late 1999.

"In Hollywood, you go to a movie because you like the artists," says Natalie Fay, Synergy's international vice president. "We think multimedia ought to be the same way. You're only starting to see the beginning of cults of personality for the artists." — David Pescovitz

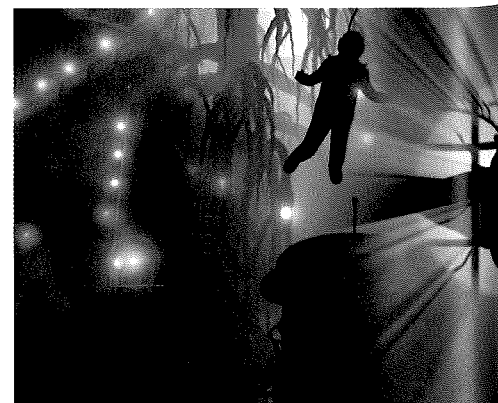


IMAGE: MICHAEL KAUFMAN/IMPACT VISUALS

Portals of Perception

Let's make a deal! Will you be Doorway Number One, Doorway Number Two, or Doorway Number Three? By Randall Rothenberg

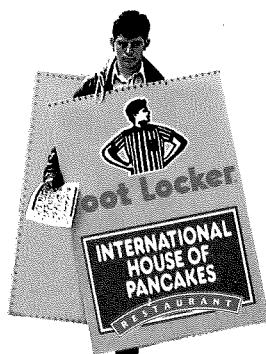
So I've decided to become a portal.

The reason is simple. My friends and family believe I've been drifting, resting on the boy-wonder thing long after both my hair and my career prospects have thinned. "What *are* you up to?" they ask, with obvious concern. The answer - "A little of this, a little of that" - doesn't satisfy them. I can't tell them the truth: In my field, communications, everything reeks of familiarity. Newspapers, magazines, books? Been there. Speech-writing, annual reports, graffiti? Done that.

But to be a portal! There's something to wake the senses. People love portals. On the Net, everybody's got to pass through them. Companies are desperate to associate with them. Wall Street is valuing them at something like 27 times 1999 revenues - present earnings being a bit difficult to come by. At those ratios, I (who, like portals, also don't have much in the way of earnings) can go from making ... well, very little, to a net worth of ... boy, a whole lot.

I willingly concede that the idea isn't original. The theory that profits lie in serving as a gateway through which consumers must frequently pass throughout the day took off about last March - around the time Yahoo! affiliated with MCI. In Internet years (roughly dog years³), that's a lifetime. Over the next few weeks, Disney bought the rest of Starwave to become a portal and Lycos did a deal with AT&T to become one too. In May, Zap Corporation, which was founded as a Texas wildcatter by George Bush and later turned to the seafood-processing market, said it wanted to buy Excite for US\$1.68 billion, a mere six times its own market cap, to transform itself into a portal.

That's when I began to think: If Zapata could rename itself Zap and go from oil company to fish-oil company to snake-oil comp-, sorry, to portal, then I could easily go from writer to editor to portal. As NBC and Disney showed by buying into, respectively, CNET's Snap and Infoseek in June, "Content is king" is for the hoi polloi. From now on, my mantra would be "Doorways are divine!"



To become a portal requires no special skill set. Forget popularity, wealth, and good looks. All that's needed is a partner. Or three.

Here was the breakthrough: I realized that becoming a portal involved no special skill set.

Let me explain. Like everyone else, I'd assumed that becoming a portal meant that people already had to be passing by me, or into me, or at least near me. And that required, at the least, heavy advertising expenditures, great looks, and - most important - a central location along the early-morning commute. After all, you just don't go around declaring yourself the new Lincoln Tunnel. You've got to dig the hole first.

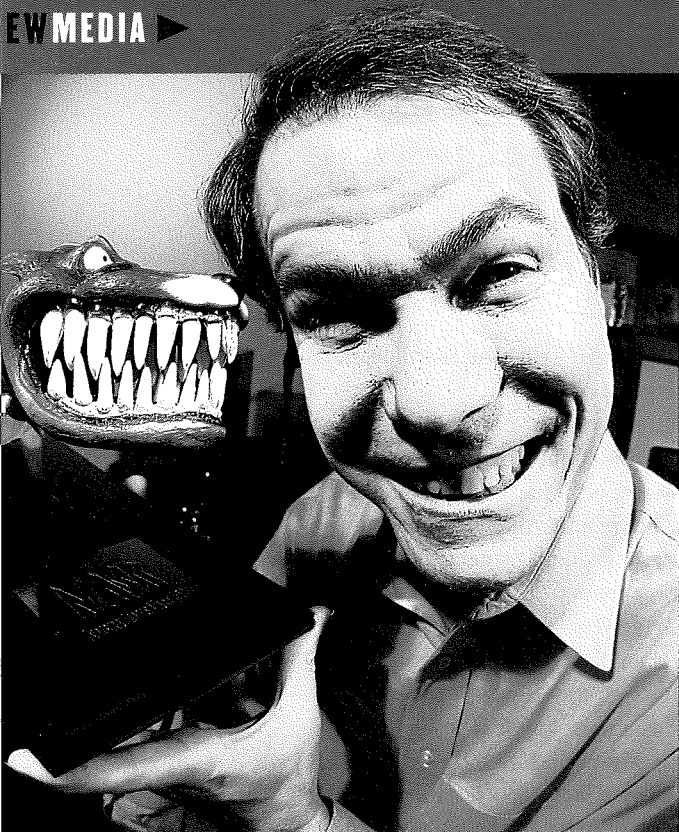
But it turned out up-front traffic wasn't necessary. The only thing I needed was a partner. Or two. Or three. Like Excite in its relationship with both Netscape and AT&T, I didn't have to be the first place people came to on the way to the office. I just had to be on the block. Even better, I didn't have to be a search engine like portaldom's Big Four (Yahoo!, Excite, Infoseek, and Lycos). According to Zona Research, portalnomics has grown so refined that it encompasses not only obvious gateways, like AOL, but secondary sites like Amazon.com and tertiary sites such as CDnow's Cosmic Credit. *Business Week* managed to define portals four ways: as doorways ("major ports of entry to the Web"), channels ("akin to the dominant TV networks"), programs (Yahoo!'s audience is "just shy of the 33.3 million viewers that TV's *Seinfeld* claims"), and marques. (Yahoo! also has "a lead-in brand recognition that's hard to beat.") "Portals is not an economic model," says Forrester Research's Chris Charron. "It's a descriptive term that has different interpretations. That confusion is to be expected."

Where some see confusion, though, I see opportunity. To be a portal, you just had to call yourself one - the same rule most writers follow!

So, following the advice of the major consultants, I'm now out there, aggregating audience, directing traffic, engaging in commerce, and transferring personal communications. Do stop by. I'm the guy in Times Square wearing the IHOP sandwich board and handing out fliers for Hooters, Foot Locker, and Steve Forbes for President. I'll also get you your tuna on rye from the Greek place. And, if you want, I'll tell you what the woman in the next office has been saying about you. ■ ■ ■

Randall Rothenberg (randall@wired.com) is a Wired contributing editor and the author of Where the Suckers Moon: An Advertising Story.

Everybody's got to pass through portals. Wall Street is valuing them at something like 27 times 1999 revenues - present earnings being a bit difficult to come by.



VISUAL EFFECTS ▲

Hollywood's Big Mac Attack

Noted for their reliance on supercomputers, effects houses are creating a commotion with the humble desktop PC. A Mac-based software package that creator Scott Squires describes as "somewhat like Photoshop for moving images," Commotion features frame-by-frame paint and digital manipulation. Its playback of uncompressed, real-time sequences is a feat previously possible only on workstations.

Frustration with bottlenecks inspired Squires, an f/x supervisor at Industrial Light & Magic at work on the upcoming *Star Wars* prequel. ILM modelers and animators hogged the SGI platforms, stranding artists engaged in the more mundane jobs of painting and rotoscoping. Why not empower the Mac? he thought. Writing code at home in his spare time, Squires made a tool that became a hit among colleagues. After considering offers from publishers, he formed Puffin Designs with ex-ILMers Forest Key and Dexter Dawes.

Commotion is now used at dozens of f/x houses, including Tippett Studios, Rhythm & Hues, and Western Images. "Some facilities have only high-end platforms," says Squires. "After they've seen Commotion, some of them have said, 'Hey, we should get some Macs so we can use this.'" — *Debra Kaufman*

WIRED AUGUST 1998

INSTANT BOOKS

Advanced Publications

On-demand, one-to-one book publishing is still a fiction, but entrepreneurial activities are pushing it ever closer to reality.

For would-be authors short on cash and book deals, there's Xlibris. This isn't your average vanity press. By automating production, Xlibris (www.xlibris.com/) charges as little as US\$300, versus the \$5,000 fees of its competitors. Publication takes mere weeks, and writers, who retain all rights, are assured their book stays in print. Professional-quality hardcovers, which sell for \$25 – \$4 goes to the writer – are printed and shipped in runs of as small as one.

One-fourth of its 90 clients are published writers, including Piers Anthony. Author of 21 *New York Times* sci-fi best-sellers, he turned

to Xlibris for an unconventional work about a Nazi love affair.

High-speed, high-quality innovation isn't just for the small-press crowd, however. New services and machines from Ingram's Lightning Print and Xerox can print and bind a different title every minute with stunning results. At \$5 per book – versus \$1 each for mass production – this economic model isn't exactly revolutionary, but it does promise a larger pool of older, less commercial books in print – and publishers are signing up in droves. Lightning Print's 36 customers include Random House, HarperCollins, and Bantam Doubleday Dell. By the end of the year, it projects 10,000 electronically stored titles will line its digital library. — *Fred Haggood*

WEB SITES

International Hits: Surfing .ru, .br, .cn



The most popular homepages based in emerging Net countries.

Country	URL	Content
Russia		
1. Chertovy Kulichki	kulichki.rambler.ru/	Humor and entertainment
2. MTR Network	www.mtrros.msk.ru/	Chat rooms
3. BizLink	www.bizlink.ru/	Web advertising agency
4. Zenon	www.aha.ru/	ISP
5. Peterlink Chat	chat.peterlink.ru/	ISP and chat rooms
Brazil		
1. Universo Online	www.uol.com.br/	ISP and online service
2. O Globo Online	www.oglobo.com.br/	News
3. Brazil Financial Wire	www.agemado.com.br/	Economic and financial news
4. Globo na Copa	www.globonacopa.com.br/	World Cup homepage
5. ZAZ	chat3.zaz.com.br/	ISP and chat rooms
China		
1. StockStar	www.stockstar.online.sh.cn/	Stock market watch
2. ZDNet	www.zdnet.com.cn/	Ziff-Davis computer news
3. People's Daily Online	www.peopledaily.com.cn/	Communist Party newspaper
4. Chinanet	www.ptt.js.cn/	ISP
5. Guang Ming Daily News	www.gmd.com.cn/	Newspaper

Source: Web21 (100hot.com/)

It's an open road and nowhere to be. It's racing through warm June air,
as thin and dry as a professor's joke. It's lots of room to hold lots of



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The Acura Integra

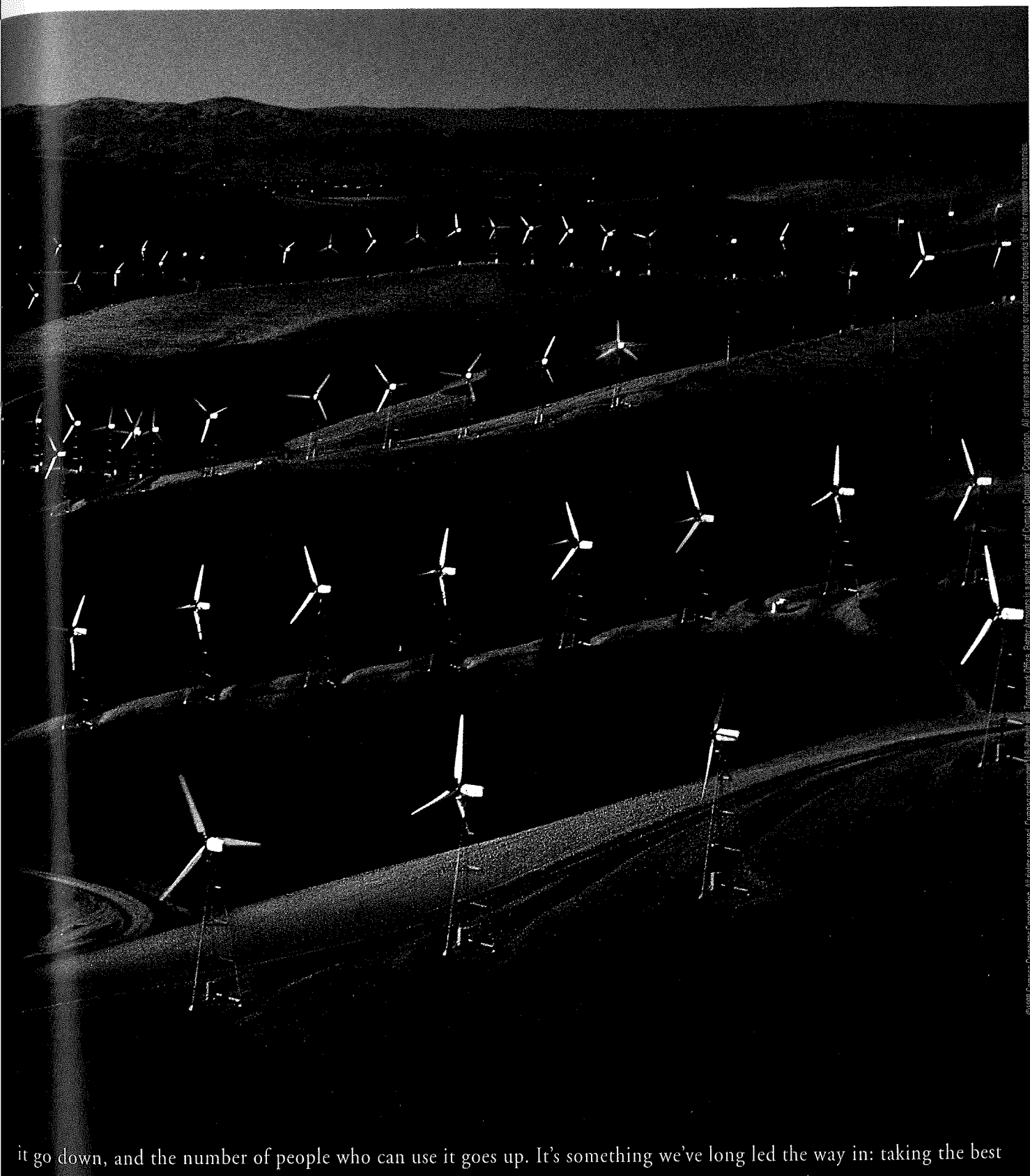
stuff (like say, your friends for example). It's engine technology born of
racetracks but sent away to private school. It's never having to think,
"Will it start?" It's being the twelfth caller. It's a million stars, just a
moonroof away. It's a road, consider it handled. It's the Acura Integra.

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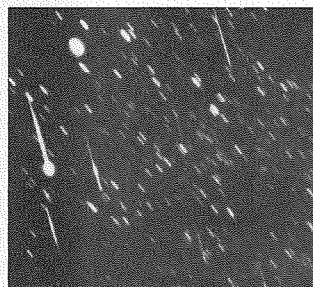
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it go down, and the number of people who can use it goes up. It's something we've long led the way in: taking the best
affordable for more people. For more answers, better answers, reach us at www.compaq.com/power or 1-800-AT-COMPAQ.

November 1998

Firestorm

With the return of the Leonid meteor shower, as many as 10,000 "shooting stars" per hour are visible over parts of Asia. The tiny meteoroids pose little threat to the planet's population or even astronauts; still, they travel with sufficient velocity to create electrical charges upon impact, which could cook



the circuitry in satellites. Back on terra firma, skygazers in the Western Hemisphere will get a chance to watch the fireworks 12 months later in November 1999, before the show disappears for a century.

Winter 1998/1999

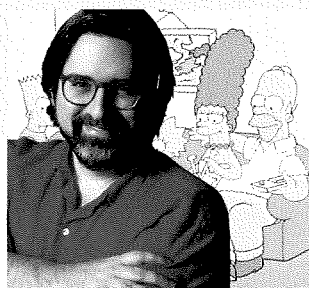
Clever Carbon

Deborah Chung, a professor at the State University of New York at Buffalo, completes a solar cell made of a superstrong carbon-fiber composite. Since the substance behaves like both a metal and a semiconductor, it can be used to create intelligent materials sans embedded circuitry. The solar cell, for instance, converts light to electricity without the presence of any wiring; in the future, the composite could be used to produce smart and sturdy airplane hulls, car bodies, even skis.

Early 1999

Laugh Track

Matt Groening, creator of *The Simpsons*, attempts to wow prime-time audiences anew with his latest animated offering, *Futurama*, debuting on Fox. The series chronicles the misadventures of an average schmo who is frozen in time – only to wake up several hundred years later and resume life as an intergalactic deliveryman. Doh!



Winter 1999/2000

Java OS

The JOS Project unveils the first consumer iteration of its all-Java operating system. Much like Unix and Linux, the new OS is built by a core group of dedicated coders and is released to the world as open-source software. But unlike other developer-centric operating systems, JOS includes a user-friendly graphical interface – which means the upstart could become a mainstream alternative to Windows.

2000

Bandwidth Halo

Angel Technologies completes its first HALO Network, offering city dwellers hungry for high-speed Net access a new and unusual option. Unlike the increasingly popular low Earth

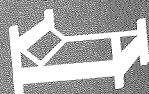


orbit satellites, the HALO broadband scheme uses a 6-ton high-altitude airplane, equipped with millimeter-wave radio transceivers, that flies over population centers and beams down data. While LEO services such as Teledesic offer a wider area of coverage, HALO serves up higher capacity – 16 gigabits of shared symmetrical bandwidth – over a 50- to 75-mile zone.

2004

Seeing-Eye Cars

The Transportation Department wraps up its six-year Intelligent Vehicle Initiative. The program is intended to evaluate the feasibility of cars that can receive traffic data from satellite broadcasts, autonomously avoid collisions, and follow instructions from smart highways. Now that the tech has been road tested, auto manufacturers can roll out the way-new options in next year's models.



T I R E D

Human Genome Project

Crème brûlée

Flat chips

Magic Johnson

Slamming

Platinum Visa

Neve Campbell

Time-release capsules

Hot war in the Horn of Africa

Holes in the ozone



W I R E D

Institute for Genomic Research

Dulce de leche

Spherical chips

Johnny Rotten

Cramming

Titanium MasterCard

Kate Beckinsale

Polymer-release systems

Cold war in the Indian subcontinent

Mass in neutrinos

*First we made it easy to use.
Then we made it easy to justify.*

NEW LOW PRICE
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SUGGESTED RETAIL PRICE



SNAPSCAN EZ

A scanner for your family's PC can make schoolwork or your work a lot more productive. Provided, of course, everyone can figure out how to use it. So we made the SnapScan EZ scanner easy to install by simply plugging it into your printer port. We also equipped it with home and office software that lets you easily manipulate your scanned images. And now, at a suggested price of just \$149, it's easier than ever to get your hands on one. To find the Agfa retailer nearest you, call 1-888-281-2302 ext. 6780 or go to www.agfahome.com. How easy is that?

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Gotta Getta Gig!

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Save \$30



— just \$398 with rebate. So if you want more space for a lot less cash, get down to your nearest SyQuest retailer now. Because this offer only lasts a limited time. After that, your gig deal will be gone. For more details visit

www.syquest.com/rebate.

All prices and rebate amounts in U.S. dollars.

But you gotta hurry. These deals will go fast.

For a limited time, SyQuest® is offering amazing rebates on removable storage. Now you can get all the room you need for a lot less than you ever thought possible. A 1.0 GB SparQ™ drive with a 3-Pack of removable cartridges is now just \$268 with mail-in rebate. That's 4 GBs of removable storage for less than you'd pay

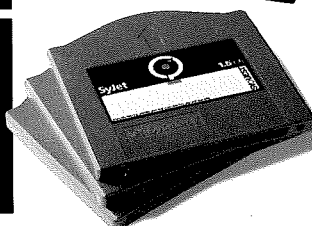
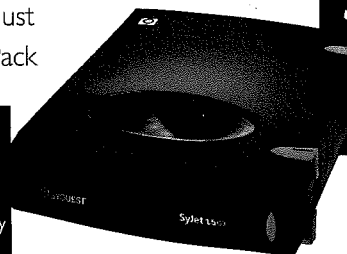
for a Jaz® drive alone! And our multiplatform – compatible SyJet™ offers 1.5 GBs of removable storage for just \$249 with rebate. Or get the SyJet 3-Pack alone for only \$169 with rebate. Add a removable cartridge 3-Pack with a SyJet drive for real savings

Save \$50

When you buy a SyJet drive.

Save \$30

When you buy 3 SyJet removable cartridges.



Save \$100

When you buy a SyJet drive and 3 SyJet removable cartridges.



SYQUEST



Digital Pinkerton

Bill Larson has transformed Network Associates into the world's largest independent security-software company.

Fear of failure drives away the sense of complacency that success breeds," recites the 42-year-old CEO and chair of Network Associates, the world's largest company devoted exclusively to security software. In five years, Bill Larson has used that fear to transform what was once a 40-person, US\$4.7 million virus-scanning-software company called McAfee Associates into a \$600 million-plus, one-stop security shop with 1,800 loyal hands.

He's also learned to talk the talk of a new economy cliché leader: "I still want people to act like we can go bankrupt if we don't perform"; "We want to be a billion-dollar company with a start-up mentality."

For Larson, who used to race open-cockpit Formula 4 cars, performing means taking risks, like the buying spree he's been on since last fall. Following the December buyout of Network General, Larson bolted together the five wheels of network security – encryption and authentication (Pretty Good Privacy), firewalls (Trusted Information Systems), intrusion detection (Secure Networks), and antivirus technology (Dr. Solomon's Group) – into one steamroller suite called Net Tools Secure running on Windows NT. "What we're saying by doing this is that in a year there won't be a stand-alone firewall market," Larson explains. "And there won't be a stand-alone authentication market."

Network Associates isn't the only one pursuing an IBM "solutions" approach. Last year, Axent Technologies rounded out its product line by merging with Raptor Systems, a firewall firm, while in March Cisco acquired WheelGroup, whose forte is intrusion detection.

At least one holdout, Internet Security Systems, insists the one-stop suite is a flawed approach. Some analysts agree, fearing Network Associates risks chaos by stuffing too many incompatible companies into one bundle; note the obvious culture clash between the cypherpunks at PGP and the squares at TIS. Ultimately, though, stockpiling partners may be the only way to secure market share. – David Pescovitz



E-COMMERCE APP

Help Is on the Web

Most of the Web remains self-serve – sales or tech support is at least an email or 800 number away. New York-based SiteBridge wants to help in real time.

The two-year-old start-up's recently released flagship product, CustomerNow, allows befuddled, annoyed, or otherwise vexed visitors to a Web site to have a real-time chat with a customer-service rep. If need be, the system also allows the rep to remotely control the customer's browser, pointing the way to a purchase or other form of clarification. And, as CEO Wendell Lansford (left) likes to

demonstrate, CustomerNow works for anyone's browser; SiteBridge's trademarked Works-Everywhere technology, affectionately dubbed "The Nose," sniffs out the platform you're on and detects whether it's Java-enabled, JavaScript-enabled, or HTML-only and then serves up the appropriate interface.

SiteBridge has competition from WebLine Communications (it has 50 corporate clients) and Aspect Telecommunications, but all three should be in demand, as vendors field the backlash of unattended Web sites.





– *Randolph Court*

CORPORATE CITIZENSHIP

E-nabling America's Disabled

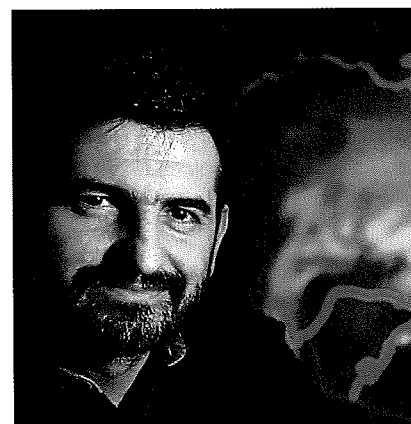
If you're among the estimated 30 to 49 million Americans with disabilities – or the 50 percent who will be by the time they're 70 – infotech is both a boon and a tease. Though the number of PCs and software programs that take various disabilities into account has increased, they typically lag behind the state of the art.

Feeling the heat from marketplace competition and political pressure, some IT giants have begun to realize the bottom-line value of adding or accommodating, for example, screen readers for the blind. Charted below is what the major creators of operating systems have (or haven't) done to capitalize on this market. – *Bob Tedeschi*

	PROBLEM	INITIATIVE	STATUS	THE SKINNY
	Rushed Internet Explorer 4.0 to market without accessibility features for the disabled.	A chastened Bill Gates held an "Accessibility Day" and increased Redmond's accessibility team from 8 to 25.	Windows 98 includes screen display improvements and a tool kit for hooking into more products.	Biggest turnaround since Scrooge.
	Mac OS 9.8 user interface only slightly easier for disabled to use than Windows.	In 1985, created the industry's most ambitious access effort, the Worldwide Disability Solutions Group.	The WDSG was 86'd in January.	Will have to improve accessibility features to keep pace with federal laws.
	Most Web designers can't crack the Java code to link accessibility features to their pages.	Has stepped up efforts to open Java to designers and added "sticky keys" (for those with motor-skills disabilities).	Lots of R&D; few time lines for enhancements.	Gaining steam, but still has a ways to go.
	User interface not disabled friendly; customers must go to third parties for (not-so-great) add-ons.	Collaborating with 14 partner companies on wide range of products and offering customer service.	Thirteen of the partner companies have products on the market; others to follow.	Effort isn't as extensive as Microsoft's, but it's a solid performance.

PETROCHEMICAL SOFTWARE

Well, Well, Well



Oil wells cost from half a million to US\$50 million to drill, and, given that only one in five produces black gold, it's easy to see why wildcatting is reserved for large corporations. But IBM scientist Ulisses Mello (above) is changing this. His software allows prospectors to combine data from various sources to better determine whether a well will gush. "It's like what's happening on Wall Street," says Mello. "This opens a niche of opportunity for small, efficient companies." – *Jessie Scanlon*

IMAGES FROM TOP: RAFAEL FUCHS; ALAN S. ORLING

IMAGE: MARK VON ULRICH

Tricks of the Trade

For individual investors, online forums are a place to dream, scheme, and run with the big dogs. But as fraud increases, forum moderators are pressed to act as censors. By Joe Nickell

On August 5, 1997, a retired New York City cop named Riley G (his real name) clicked into an obscure thread on the Silicon Investor Web site and posted a message. In it, he alerted others of his ilk to "the possibilities here of making money." Market makers, G asserted in a series of posts, had sold more shares of Olympus Ventures than had been issued, and those who bought the remaining shares could sell them back to the oversold brokers in what's known as a "short squeeze." For anyone confused by the lingo, G made it plain: The stock, then trading for about two dimes per share, could be driven up to US\$400 to \$500 per share. The crowd went wild.

"I just bought 3,000 shares to show my support," wrote one visitor. "Yes, I'm crazy too. We're all crazy. Now let's make some money and be even crazier."

By December, there were more than 30,000 posts to the thread, but by then the tenor of many of these had changed. The Securities and Exchange Commission suspended trading of Olympus stock (by then renamed Rocky Mountain International), and when the SEC halt lifted 10 business days later, Rocky Mountain itself refused to allow trading to resume. G's promise of easy money went unfulfilled.

"What the Silicon Investor people did was not good for our company," says Rocky Mountain CEO Gary Morgan, who believes that shorters, frightened by the possibility of being squeezed, set out to harm the company's reputation.

Though this tale may not be run of the mill, stories like it are not uncommon. The convergence of equity markets and the Internet has inspired a bum rush, and, as online investment and trading scams increase in frequency and subtlety, the gatekeepers of stock discussions such as Silicon Investor and The Motley Fool find themselves pressed to become traffic cops, even censors.

Back in the day (1995, say), the grifters were relatively easy to spot. In August of that year, for instance, the SEC filed a complaint against Daniel Odulo, who was offering

bonds via newsgroups for an eel-farming company called Golden Waters. Odulo promised a "whopping 20 percent rate of return"; the SEC pointed out that such a rate would be difficult from a company that didn't exist.

Lately, however, even the cautious can be tricked. Touted by SGA Goldstar Research, an online newsletter, Systems of Excellence seemed a legit operation offering teleconferencing technology. But in January 1997, a Virginia federal court sentenced Systems of Excellence CEO Charles Hutto to a 46-month prison term and fined him \$10,000 for securities fraud.

Thanks to what remains of the 1996 Communications Decency Act, BBS moderators and webmasters are not liable if they too get duped. Yet few trust in the CDA, and few have forgotten *Stratton Oakmont Inc. and Daniel Porush v. Prodigy Services Co.*, a 1995 case heard in the Supreme Court of New York. Prodigy was found responsible for posts made to its Money Talk threads.

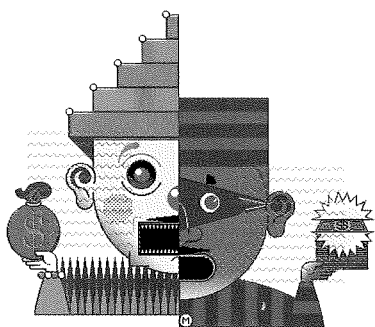
"Any organized community has to have rules and regulations that people abide by, and ours is no different," says David Forrest, community coordinator at The Motley Fool. "We're not responsible for what someone else posts," but, he adds, "when we see things that violate our rules, we remove them." Forrest notes that The Motley Fool employs a full-time staff of 20 to monitor content and remove anything inappropriate – which, to The Motley Fool, even includes discussion of stocks that trade for less than \$5 a share. Silicon Investor now also keeps an electronic eye out for trouble. The company tracks the whereabouts of "problem users" on the site.

Ultimately, more rigorous methods of filtering will be necessary for the Motley Fools of the world to gain and keep the faith of investors – particularly the wealthiest and most conservative traders. The challenge is how to do this without stifling the unfettered debate and dish that makes online forums exciting.

"There's always a possibility of further problems," shrugs John Keister, chief operating officer at go2net, which purchased Silicon Investor this spring, "but I guess that's what insurance is for."

As for Riley G, when he's not maintaining his Psychic Detective Web presence, he's keeping his eye on Rocky Mountain. Says G, "I'm in this for the long haul." ■ ■ ■

Joe Nickell (j@rox.com) resides in a Montana basement, where he coproduces Rox, the first online TV series.

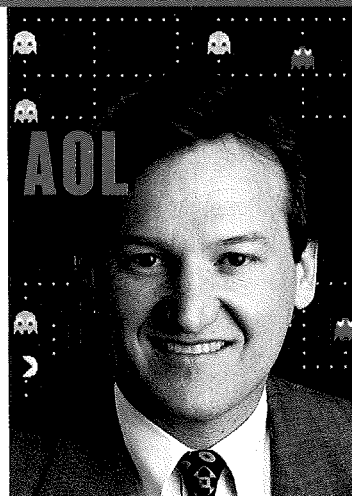


The convergence of equity markets and the Internet has inspired a bum rush. Now "problem users" pose a threat to both your money and unfettered debate.

"Any organized community has to have rules and regulations, and ours is no different," says The Motley Fool's David Forrest. Violate his rules, and you're out.

ISP STRATEGY

The Stealth AOL



To prosper, Internet service providers have generally followed one of two paths: leverage economies of scale (e.g., America Online or WorldCom/MCI) or go the small-is-beautiful route. (See "Bit Players," page 96.) Verio is doing both.

During the past year, the Englewood, Colorado, company has acquired a number of relatively small ISPs around the US: Washington's NorthWestNet, Texas's OnRamp Technologies, California's Network Intensive. It's part of an effort to create a national franchise of local ISPs offering a combination of fast, deep reach – secured in part by a US\$100 million deal with Qwest – and homey customer relations. It's like a newspaper chain: Readers get local coverage reported by their neighbors, but their subscription checks get cashed out of town.

Analysts are consistently bullish on Verio. The company gets high

marks for being selective about the ISPs it buys, and Verio's May IPO should reinforce its Pac-Man tendencies. "When we started," says Verio CEO Justin L. Jaschke (above), "small and medium businesses could go to a local ISP and face the possibility that it wouldn't be around for a long time or wouldn't be sophisticated enough. Or they could go to a big national company, and, whenever they needed something or had a question, they had to call someone at the other side of the planet." Now, Verio claims to offer the best of both worlds.

— Ilan Greenberg

INTERNET BANKING

Superhighway Robbery

Russian nationals Serbevo Ushakov, Vietlui Papsouev, Alexandre Konanykhine, and Mikhail Khodorovsky are suspected of getting rich off the Internet. According to conflicting press reports, all four played a role in the collapse of the Antigua-based European Union

Bank, touted as the world's first Internet bank when it opened in 1994. The EUB principals had not been seen on Antigua for months, when in August 1997, US\$6 million of the bank's deposits vanished and the EUB site went 404.

Well, the deposits didn't exactly vanish. Just before it vaporized, the bank wired \$4.8 million to a Russian bank, lending credence to the theory that the EUB was a scam masterminded by the four. A year out, the cleanup crew – including the FBI – has no new leads. — Ben Greenman

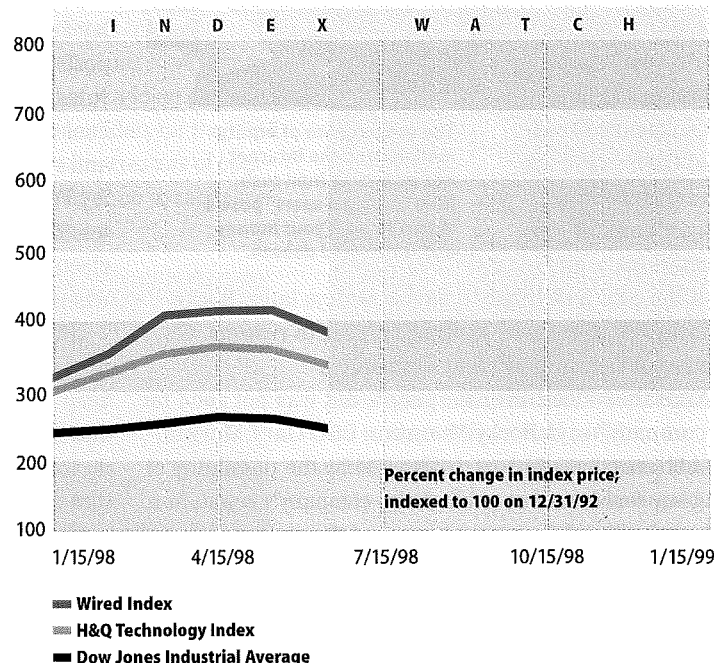


WIRED INDEX

Seeds of Change

Summertime, and the assets are shuffling ... No sooner had the ink dried on Monsanto's US\$2.5 billion check for the 60 percent of Dekalb Genetics (America's Number Two seed company) that it didn't already own than Monsanto itself agreed to a \$33 billion merger offer from American Home Products. AHP, the folks who bring you Robitussin, Advil, and Chap Stick, reckon they can save about \$1.5 billion a year by combining with Monsanto, perhaps fashioning painkillers from herbicides. And their claim to huge savings puts to test an idea that seems to obsess pharmaceutical CEOs: economies of scale in knowledge. Frankly, we're skeptical, but we'll keep Monsanto on the Index to reflect the test results ... WorldCom and MCI, meanwhile, are conducting a more subtle experiment. MCI promised to sell its Internet backbone business (service contracts) to Cable & Wireless, so the trustbusters will give its merger with WorldCom the go-ahead. But MCI is not actually selling any of the fiber-optic cables that carry the business it's selling off. If in three years time it wins back some of that business, keeping the fiber will overturn another popular theory: It's better to own the contracts than the infrastructure.

— John Browning



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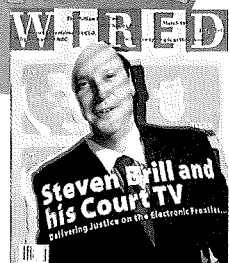
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Something New, Something Blue



In March 1995 ("True Boo-Roo," *Wired* 3.03, page 136), *Wired* reported on Nichia Chemical's creation of the first blue light-emitting diode fabricated out of a semiconductor called gallium nitride (GaN). The breakthrough by Shuji Nakamura, a stellar researcher at the small Japanese company, represented a giant leap toward a long-sought goal in optical engineering: the blue laser. Think of the blue LED as a minivan — necessary, dependable, and totally unexciting. But the blue laser is a whole new sort of automobile.

The smaller a laser's wavelength, the smaller a spot it can form, producing tinier pits on a CD's surface. With a short wavelength of 400 nanometers, a blue laser could be used to store 15 Gbytes of data on a standard CD. Compare this to the 0.65 Gbytes of storage via 780-nm lasers on a CD today, and you see why the little blue lights are such a big deal.

In December 1995, drawing from Nichia's LED work, Nakamura fabricated the first GaN laser: a ray that worked for just a few seconds and operated in a pulsed mode (more off than on) to prevent overheating. Since then, however, Nichia has developed a blue laser that operates in continuous CW mode. The sophisticated device incorporates multiple layers of GaN and GaInN (gallium indium nitride) — some layers only a few atoms thick — into a laser powerful enough not only to read the microscopic pits in a CD, but to blast them into a CD's surface, making this laser suitable for read/write applications.

Again, Nichia was first out of the gate. According to Steven DenBaars, who developed a GaN blue laser at the University of California at Santa Barbara, Nichia has a two-year lead. "Even one and a half years after Nichia announced reliable CW emission, no other group has attained a long-life CW laser. This is unprecedented in semiconductor research, where advances are usually repeated in a few months by other large electronic companies." And if Nichia's technical edge is not enough to keep them ahead, its patent portfolio will help. "Nichia has 500 patent applications," Nakamura reports. "Thus, it is difficult for other companies to manufacture laser diodes and LEDs without a license from us."

Of course, patents and a two-year lead will not stop other players from competing — the stakes are too high, the rewards too great. Cree Research, Hewlett-Packard, Xerox, Toshiba, and others have produced their own blue lasers, though so far none can compare with the performance of Nichia's. Most researchers are still struggling to get their lasers to operate at the high power levels Nichia's are capable of, and even when they can, the devices burn up in a matter of minutes. Trying to leapfrog Nichia's technology, Cree uses high-conductivity substrates to reduce heating effects, and HP's ridge-waveguide laser structure operates in a single lateral mode, making it ideal for data-storage applications.

In the meantime, though, Nichia's still well ahead of the pack in the rush for blue gold. — Robert A. Metzger



Telecosm Infinitum

"Telecosm is the ultimate vapor book," Po Bronson wrote in his profile of the *Forbes* ASAP columnist and publisher of the *Gilder Technology Report* ("George Gilder," *Wired* 4.03, page 122), noting that the sequel to Gilder's 1989 best-selling *Microcosm* has been promised every year since 1993. More than two years have come and gone since Bronson's piece, and, until recently, the *Forbes* ASAP Web archive promised a 1998 publication date. But at press time Gilder's publisher, Simon & Schuster, had still not listed the title in its 1998 catalog.

Gilder's problem? Internet time lapses publishing time at an increasing rate — meaning the emerging technologies *Telecosm* is supposed to describe are, unfortunately, emerging ever faster. The book has devolved into an endlessly revolving exercise in writing, rewriting, and rewriting again.

As of early June, Gilder was still at it, aiming at another approaching deadline. "In the past 90 days he's written about 70,000 words," said Chuck Frank, vice president of Gilder's consulting company. "He's really cranking on this."

Still, if attendees at Gilder's second annual Telecosm Conference this September want to beat their techno-utopian host at a game of Stump the Futurist, they might try the following question: "George, where's the book?" — Chip Bayers

Holding Pattern

When *Wired* wrote about Boeing's plans to use experimental augmented-reality equipment on the production line ("Wiring the Jet Set," *Wired* 5.10, page 128), the Seattle behemoth was ecstatic about the beta project's potential. AR would allow workers to lay the miles of wire required in a jumbo jet without having to juggle unwieldy schematics or leave the shop floor to consult drawings.

But merger mania intervened. When Boeing bought McDonnell Douglas in the summer of 1997 (after acquiring Rockwell International's space division almost two years ago), the company found it had more than one VR program to consider. The newly purchased companies were already developing their own AR technology — using different platforms. While the projects don't differ radically, Boeing decided to take the time to evaluate all three before moving forward. That put "everything in a holding pattern," according to spokesperson Bob Jorgensen.

Now, Boeing won't commit to one AR technology until the fourth quarter of 1998. The delay could be a matter of due diligence; it could also be related to last year's billions of dollars in charges against earnings. — Ian Greenberg



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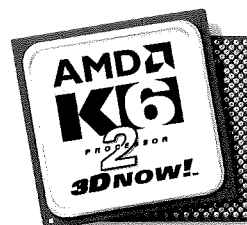


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IMAGE: WILLIAM MERCER MCLEOD



Smart Pharmmer

Starting with computers, not humans, Pharsight's Camilla Olson shows pharmaceuticals a shortcut to successful clinical drug trials.

Critics contend that the only thing standing in the way of powerful new therapies for AIDS, breast cancer, and numerous other diseases is the antiquated clinical drug trial, which can take up to 10 years and cost millions of dollars. Camilla Olson, founder of Palo Alto, California-based Pharsight Corporation, wants to cut this process in half with speedy simulated trials on silicon subjects.

Olson's new Trial Designer software reduces the number of clinical trials—and the reliance on human subjects. Through extensive database comparisons, it knows what worked in the past and what didn't. And from that information researchers can run sophisticated what-if tests to predict

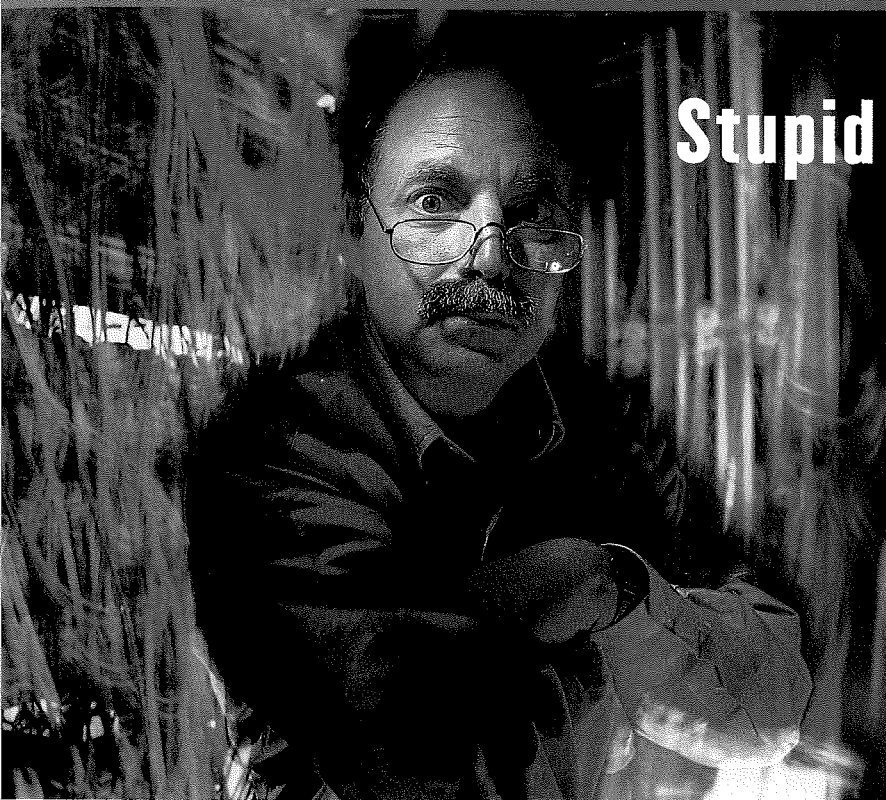
a range of biological responses to a particular drug before undertaking an actual clinical trial, using humans only for final testing.

Trial Designer has grabbed the attention of several pharmaceutical and biotech companies. Glaxo Wellcome and 18 others are now testing Pharsight's software. That's pretty rapid penetration for a new medical product.

"People in the industry know there is a problem, but everyone has been waiting for a proof of concept," says Edmund Capparelli, codirector of the Pediatric Pharmacology Research Unit at the University of California at San Diego. "Pharsight comes awfully close to being that proof."

Olson, a 20-year research and marketing veteran of pharmcos like Johnson & Johnson, got the idea for Trial Designer while developing a drug for reducing the chance of miscarriage or premature birth. "There was a body of knowledge in clinical pharmacology that wasn't well used," explains Olson. During her research, she found that data was wasted once a clinical trial ended. Trial Designer now crunches that data to anticipate findings that otherwise would have to be tested again.

"With computer-aided trial design," says Olson, "drugs will be on the market faster, which means room in the development pipeline for more drugs." — Paul Kedrosky



Stupid Is Smart

NETWORK ARCHITECTURE

David Isenberg has emerged from the belly of the beast. Last year, as a member of AT&T's technical staff, this self-described telco nerd sparked an influential debate with his essay "Rise of the Stupid Network." In that essay, Isenberg argued that the "intelligent" architecture of the telephone networks has retarded innovation, while the Internet, by offering "stupid bandwidth," has become a breeding ground for smart apps. Not surprisingly, the relationship between Isenberg and AT&T turned cool. Today, he runs his own shop, calling himself a "prosultant" ("con is negative," he sniffs) on next-generation networking. Here's the iconoclast on what's next for networks. — *Steve G. Steinberg*

Meet the new Net, same as the old Net. "We're already seeing intelligence start to rear its head in the Internet. New protocols, like RSVP (which tries to guarantee users a specified amount of bandwidth), require a smart network. We need to find stupid solutions to these problems to avoid the same kind of big monopolies we have in the telephone industry."

Voice isn't the killer app. "The real win for voice-over-IP will be allowing people to mix real-time voice with data, images, and video. In the meantime, the circuit-switch guys will have to reduce prices to stay competitive — and still offer better quality."

The customer doesn't know best. "If you're listening to your customer it's almost preordained that you'll miss the new market. And when the new market expands to encompass the old market ... that's when companies can become obsolete."

Why AT&T is doomed. "Today, Internet telephony has crummy voice quality. The average telephone customer couldn't stand it. But suppose that Net people start using voice to, say, supplement online gaming. Because it starts off looking more like a Nethead game than a phone call, AT&T might not realize how cross-elastic it is with telephony until it is too late."

IMAGES FROM TOP: GERRY GROPP; DAVID COMBS

FINANCIAL PROGRAMMING

More Buck Per Bang

Advanced financial applications are what's helping make the global economy, well, global. These programs are designed to crunch massive amounts of numerical data and perform such mission-critical tasks as following the minute-by-minute fluctuations in world bond markets.

Into this world of demanding code writing has come a new programming language called K. "Code written in K has a very small footprint," says Janet Lustgarten, CEO of Kx Systems, the Palo Alto, California, company now marketing the language. "With K you can do in 158,000 bytes what would take more than 10 million bytes in Java." Its efficiency comes from both the interpretation engine and the small but very powerful set of modified ASCII symbols used to write the code.

Kx Systems recently licensed K to financial-apps developers at Union Bank of Switzerland and Zurich Insurance.

How good is K? "Say you had to program a human body," says Wayne Miraglia, a former K software developer for Union Bank of Switzerland. "A C programmer would have to write reams of code just to cover things like respiration and heartbeat before making the thing walk. With K, the programmer can simply write a line that says, 'Dance.'"

— *Hal Stucker*

STRUCTURAL ENGINEERING

Safe House

The goal is to build homes more resistant to natural disaster," explains Jack Simon, head of the Partnership for Natural Disaster Reduction. Simon and researchers at the Idaho National Engineering and Environmental Laboratory are building the world's largest wind-storm simulation center — a wall of more than a dozen turboprop airplane engines. The gigantic storm machine will simulate cyclones with 200-mph

winds. By adding water and particulate matter, engineers can create a full-force hurricane on demand. — *Alex Frankel*

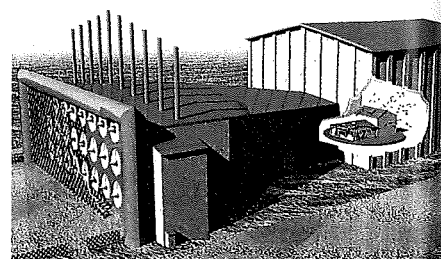


IMAGE: PHYLLIS CHRISTOPHER

Living Room LAN

The key to the much-touted smart home won't be wireless networks, but plain old telephone lines. By Steve G. Steinberg

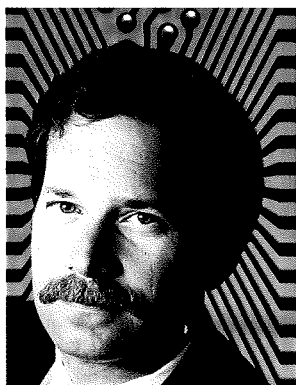
Only a telephone company could have come up with a phrase like "the last mile." It requires the kind of self-importance fostered by years without competition to assume you are at the center of the universe – that the customer represents the last mile, not the first. And it takes a traditional telephone mind-set to think that once you've got the wire to the home the problem is solved – after all, inside wiring is the customer's problem.

It's becoming clear, however, that the most exciting area in networking is exactly what the smug telco phrase ignores. Home networks will be the nexus for some of the most important new developments in the industry.

Two trends are making this happen. Most noticeably, an increasing number of households now have more than one computer, thanks to the sub-US\$900 PC. And while there is some question as to whether you really want Junior to be able to access your personal files over a network, the ability to share a single printer in one house makes good fiscal sense. Second, high-speed Internet connections in the form of xDSL and cable modems are beginning to be deployed, and the best way to allow all the devices in your house to share such access is by networking your home.

Although it's received precious little attention so far, the home network has started to show up on the radar screen of a few of the more perspicacious companies. At Cisco it is known as SpudNet – as in couch potato – and is seen as a key strategic direction. Microsoft has already gotten its hands dirty with its self-appointed role of brokering an in-home networking standard. But probably the most exciting work is being done by a small seven-year-old private company called Tut Systems, based in Pleasant Hill, California.

Tut's HomeRun package has overcome the two biggest constraints of in-home networks: cost and complexity. Networking the home cannot cost more than \$50 per PC, and ideally it should be included for free. Furthermore, it can't require any additional wiring – only the most hardcore aficionado will string networking cable throughout the house, and even people buying new homes will likely find that running additional wire is a huge hassle.



Tut CEO Sal D'Auria offers a home Ethernet network that's "faster than what most people are used to at the office" – at very low cost.

Tut ingeniously solves these problems by using the phone wiring that already exists in your home. Its technology can transmit standard Ethernet data at 1 Mbps over normal telephone wire using a frequency range well above that used by the phone system. That means you can plug the downstairs and upstairs PCs into nearby RJ-11 jacks, and then play networked *Doom* between the two while still talking on the phone.

"The phone wiring in your house is like a huge, random tree that branches off to different rooms and extensions," says Tut CEO Sal D'Auria. Nonetheless, he argues, "one megabit per second is actually faster than what most people are used to at the office. Most office LANs run at 10 Mbps but are shared by at least 10 people."

Because Tut uses the standard Ethernet protocol, it can offer its product at very low cost. And by the end of the year a series of Ethernet controller chips made by semiconductor giant AMD, which has about a third of the market, will include Tut's HomeRun technology at no additional cost. These chips will turn up a few months later on the low-end \$50 to \$60 Ethernet controller cards found at CompUSA and on the preinstalled cards that come with many new computers. Then networking the home will be as simple as plugging into an RJ-11 jack.

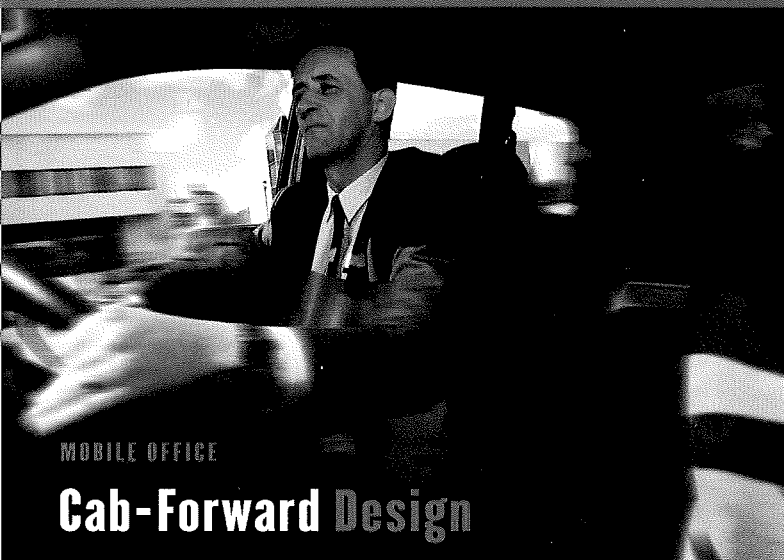
The long-predicted "smart home" is the most obvious new application: Devices like lights, alarm clocks, and coffee machines will finally have a way to communicate. And what's different this time around is that it will all be based on standard protocols like Ethernet, IP, and HTML.

Of course, there are still problems. Perhaps most critical is the need for easier-to-use software. Despite Microsoft's efforts, networking computers together can still feel more like plug-and-pray than plug-and-play. There is also plenty of opportunity for standard battles to erupt. Tut is not the only company with technology for transmitting data over home phone lines – Sunnyvale, California-based start-up Epigram is also developing a system. And while Microsoft has backed Tut's protocol, Intel is researching an entirely different technology that transmits data over the AC power lines inside your home.

Which technique wins doesn't matter, but the longer it takes for them to duke it out, the longer it will be before prices hit the mass-market level. And the longer before I never have to get up from my computer again. ■ ■ ■

Steve G. Steinberg (sgs@best.com) is a Wired contributing editor and a consultant for a New York investment firm. Portfolio managers he consults for may have long or short positions in the companies mentioned.

You can plug the downstairs and upstairs PCs into nearby RJ-11 jacks, and then play networked *Doom* between the two while still talking on the phone.



Cab-Forward Design

A cab ride across a busy metropolis can turn into a nightmare of traffic delays and detours. Capitalizing on that downtime is Jarlath MacNamara (above), founder of Dublin, Ireland-based Cabs-on-line. He has fitted a Ford Galaxy taxi with an array of tech gear, including a laptop with email and browser, a cell phone, a wireless modem, and a fax. "Cabs-on-line is in discussion with a number of global organizations regarding expansion," says MacNamara, who plans to have 10 cabs on Dublin's roads by September. — *Dave Walsh*

INTERNET UPGRADE

Following Protocol

The Internet's architecture is decaying," says Steve Deering (right), a graying member of the standard-setting Internet Engineering Task Force and technical leader at Cisco. Deering cochairs the IETF's Internet Protocol Next Generation working group and for the past six years has been a chief proponent of IPv6, an overhauled version of the existing Net protocol.

As proof of IPv4's impending obsolescence, Deering points to the countless band-aids performed over the years that have, for instance, increased the time it takes routers to inspect packet header instructions. What IPv6 introduces instead is a larger numerical

address space, more efficient encoding of these addresses, and "new classes of service for prioritizing data traffic."

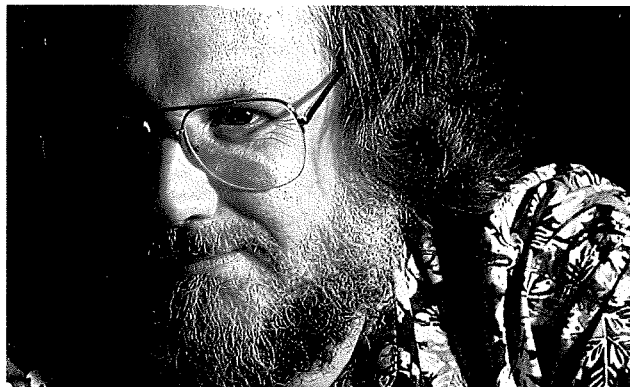
But while networking vendors like Sun and Digital see IPv6 as a profit generator and are currently beta testing their IPv6 equipment, ISPs are dragging their feet, calling the new protocol a costly undertaking that lacks urgency. Mike O'Dell, vice president and chief scientist at UUNet Technologies, one of the nation's network-backbone operators, insists IPv6 is simply underwhelming. "IPv6 really is just IPv4 cleaned up," he says. O'Dell and others posit that every feature in IPv6 can be done in IPv4. With intelligent rationing of existing IP

addresses, they say, the IPv4 space might never run dry.

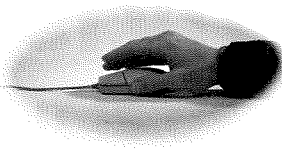
Yet elongating IP addresses may not be IPv6's greatest contribution to handling the Internet's exponential growth. With IPv6, Deering says, every network device would be auto-configurable — great news for laptop, PDA, and mobile-phone makers and users, whose devices would be equipped

with globally unique addresses out of the box.

Even as O'Dell calls IPv4 "the Fortran of protocols," because of its potential for hanging on for decades after it should, chances are it'll soon have to make room for the better, if buggy, IPv6, which Deering predicts will reach the final standard-making stage later this year. — *Roderick Simpson*



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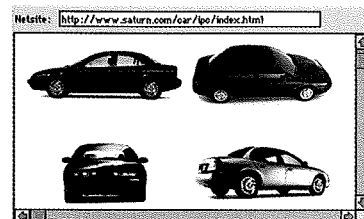


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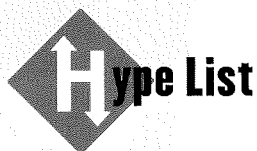


The 1998
Black Top Coupe

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Deflating this month's overblown memes.

By Jesse Freund



↑ On the Rise
↓ In Decline

Embedded NT

1

12

Ranking

Life Expectancy
(Months)

Redmond is expanding its beachhead in the networking world with embedded NT, a version of its operating system designed for switches, routers, and PBXs. But even if NT's code is pared down to fit into networking equipment, custom-built OSes will still be smaller, cheaper, and more robust. Yes,

NT features the familiar Windows interface, but the price and sacrifice in memory and reliability will tax any real-time corporate network. When my fridge gets "smart" enough to leave messages on my voicemail, I'll call Microsoft – until then, embedded NT should be kept on hold.

Certification Authorities

2

18

Now that *ecommerce* is every investor's favorite buzzword, analysts are hyping the arrival of a public key infrastructure that makes network authentication, encryption, and authorization pervasive. Yet certification authorities, the parties that verify a message's sender, must guarantee

privacy before they can convince John Q. Public to spend cash online. Companies such as VeriSign keep touting their digital certificates, but legislative and judicial bodies will increasingly scrutinize private key authentication. When it comes to *ecommerce*, the technology is the easy part.

Shopbots

3

3

Technologies that make your single-family-home life more convenient are hot, and none are hotter than shopbots. These Web-based agents, offered by companies like Junglee, search many different commerce sites for the best bargains. At the same time, however, the big-name searchcos are busily

latching onto one-stop "portals" to the products and services of the great electronic mall. And if there's anything to be learned from the success of Amazon.com and CDnow, it's that people enjoy the ritual of browsing before they buy. Why let the bots have all the fun?

Chrome

4

9

If you've developed a 3-D technology that drains way too much processing power, don't worry: You can always pitch it as a "business application," assuming you've got Microsoft's marketing clout. Take Chrome, the Windows enhancement that delivers lively visuals to browsers and other

applications via DirectX and XML. Sounds good, but Chrome runs only on 350-MHz Pentium II PCs, which effectively prices it out of its logical niche in the consumer market. And, as a wise exec once said, "3-D accelerators are used for two things: games and 3-D benchmarks."

Cyber Cosmetics

5

3

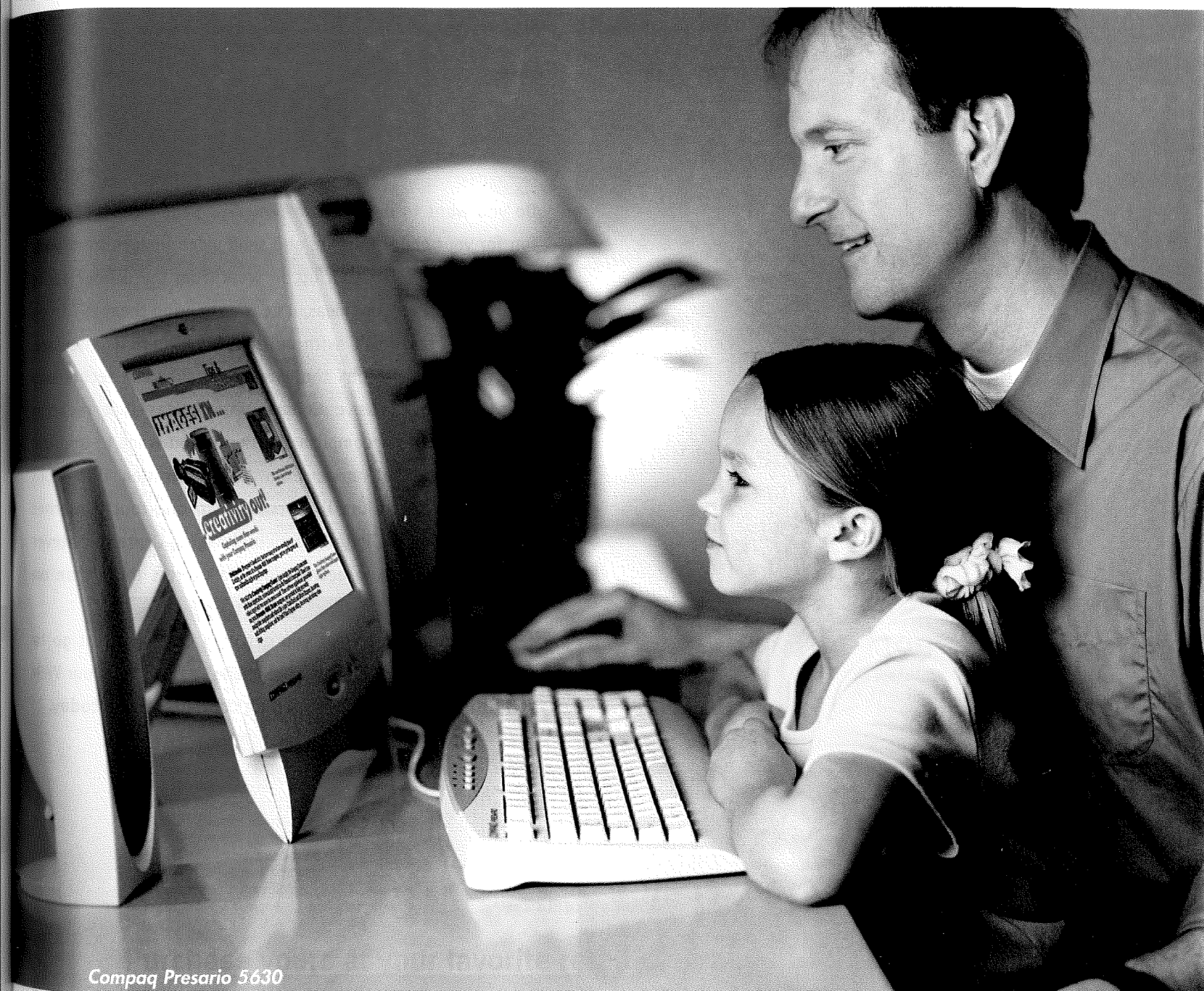
How to further tech-cessorize a wardrobe that already includes computer-chip earrings and the Swatch @ watch? Why, cyber make-up, of course. Clinique's Moisture Online, M.A.C.'s Cyber lipstick, and Lancôme's Morphing Violine nail polish are just some of the items now gracing department

store counters. The most brazen form of the new hack couture is called E-Nail, a trio of products that map cutesy graphics onto fingernails. Apply the Icons with a fixative called Command-Save. If you don't like the look and feel, buy the remover. It's called Delete.

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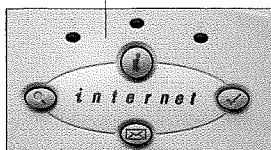
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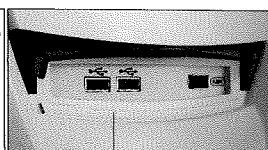
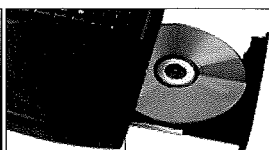
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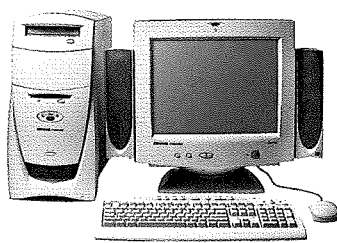
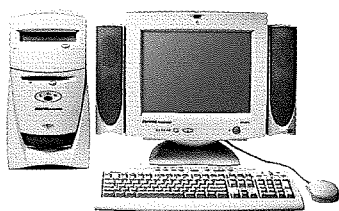
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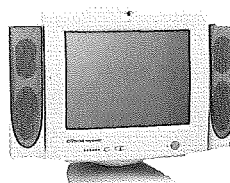
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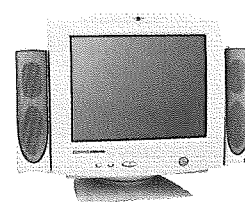
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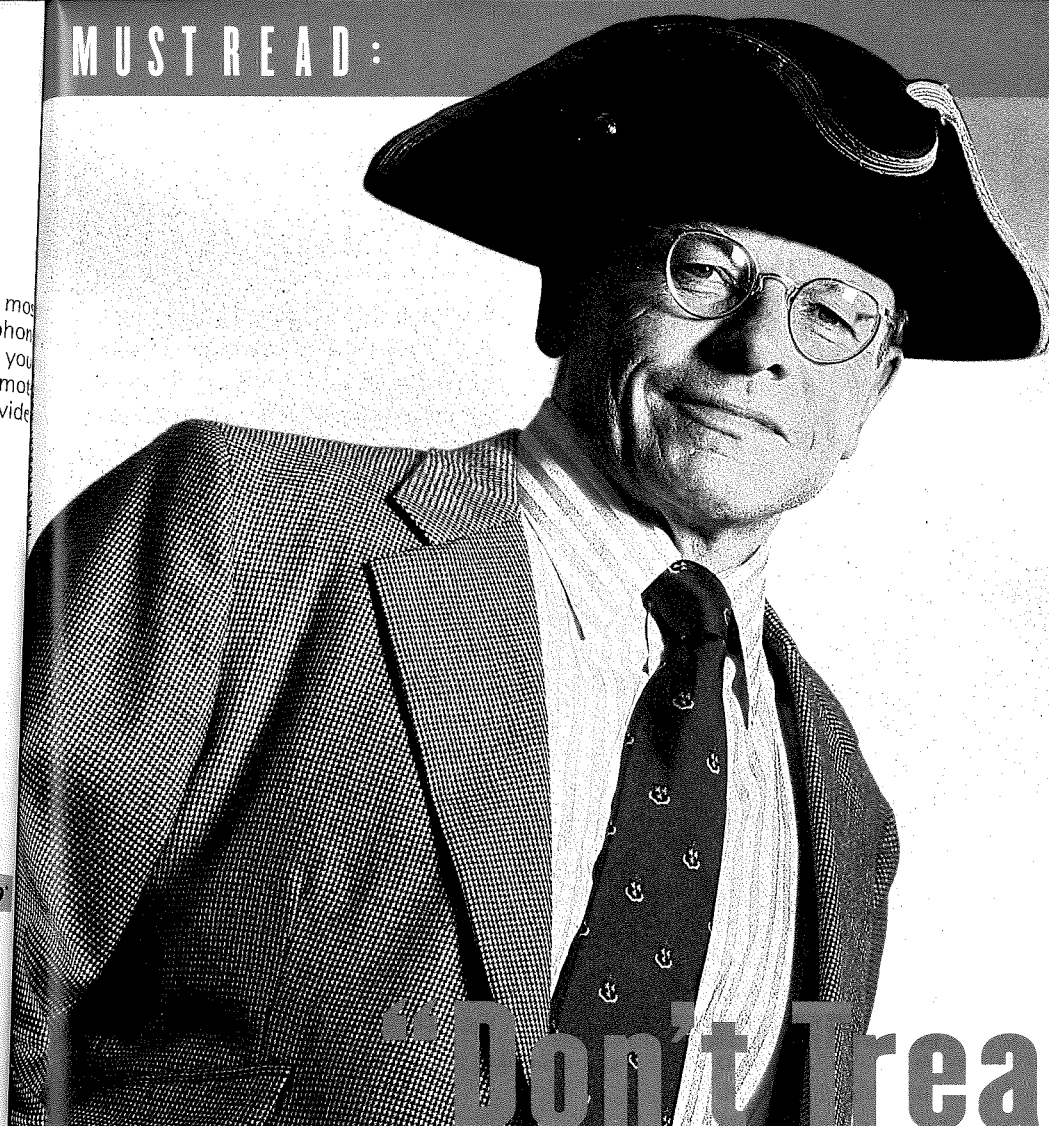
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IMAGE: ROBERT HOUSER

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"Don't Tread on Me"

Cypress Semiconductor CEO T. J. Rodgers is leading a campaign to stomp out corporate welfare – and renounce the Valley's new political style.

While Silicon Valley heavyweights like John Doerr and Jim Barksdale are cozying up to Washington, Cypress Semiconductor CEO T. J. Rodgers is keeping the distance. Bucking a trend that has seen California biz bigwigs appealing to the federal government for help in dealing with problems ranging from a shortage of skilled workers to anxieties about Microsoft (see "Netscape's New Rules," page 93), Rodgers is signing up Valley leaders to end subsidies for high tech companies.

"Valley CEOs haven't changed," Rodgers roars. "We are capitalists who make money by making things. Government only subtracts from that!"

Each year, the US government gives

away nearly US\$65 billion in corporate subsidies – handouts that arrive in the form of tax breaks, export incentives, and pork-barrel contracts. Rodgers argues that these policies only harm competitiveness and increase taxes. "Politicians are destructive people," he says. "They give us their money, then take away taxes and our freedom in the marketplace. That's the game."

Since asking a Senate subcommittee last year to end "corporate welfare" – even if that translates into funding cuts for his company – Rodgers has persuaded 78 Valley entrepreneurs to sign his "Declaration of Independence" from subsidies. Cosigners include Scott McNealy of Sun Microsystems, Scott

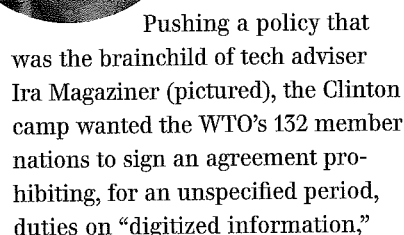
Cook of Intuit, and Jerry Sanders of Advanced Micro Devices.

Critics point out that Rodgers may find it easy to turn his back on the government. His \$550 million company, described by one analyst as "token change," has little to lose if assistance is cut off. Netscape public-policy counsel Peter Harter adds that the Valley's separatism is doomed. "If you're a long-range thinker," he says, "you have to get involved."

But even if they disagree with his antipolitics, Rodgers's friends are willing to join his cause. "T. J. is seldom without an opinion," says cosigner and Kleiner Perkins VC Floyd Kvamme. "He's a great American." – *Jennifer Hillner*



Having failed last year to secure congressional renewal of its "fast track" negotiating authority for international trade agreements, the Clinton administration's free-trade agenda has suffered a new setback. The White House had hoped to use the



such as downloadable software or data. Magaziner says the accord was designed to codify "the principle that cyberspace should be unregulated and that the Internet should stand as a seamless global marketplace."

But then reality got in the way. European officials complained that the tariff freeze diverted attention from more controversial issues like encryption and privacy protection. Developing nations, worried about the financial impact of the proposal, balked at an open-ended agreement. In the end, the US had to settle for a temporary freeze to be reviewed in late 1999. Still, that modest step forward may be one of the biggest trade endorsements the Clinton administration receives this year.

– *Tim Dickinson*

Hit the Road, Union Jack

With Australia poised to hold a referendum next year on rejecting its Commonwealth status, polls show that a majority already wants to remove the Union Jack from the national flag. With that in mind, last fall a nonprofit group called Ausflag sponsored a professional flag-design competition. Almost 3,000 entries were received, and Aussies have until the end of this year to vote for their favorites. The top three will go to the Australian federal government for consideration. Only Australians are eligible to vote, but anyone can check out the contenders at www.ausflag.com.au/. And, no, none of the proposals feature Vegemite.

– Geoff Shandler

– **Geoff Shandler**

WIRED AUGUST 1998

Netscape's New Rules

Jim Barksdale knows how much an embattled company can do with a lot of lobbying muscle. Is the rest of the industry paying attention? By Will Rodger

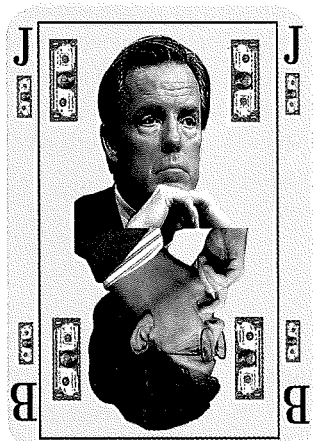
Forget stock price. Think political capital. That's the plan at Netscape Communications, and it's paying dividends. Although Netscape has taken a beating on Wall Street, the company's stock has been on the rise in Washington ever since the Justice Department launched its antitrust lawsuit against Microsoft in conjunction with 20 states. And now that Intel has joined Microsoft as an antitrust target, the rest of the industry may want to take a closer look at Netscape's playbook.

Thus far Microsoft has taken a beating. Although pundits have made much of Microsoft's decision to spend US\$1.9 million beefing up its lobbying presence last year, the company's woes suggest that throwing money at an antitrust problem won't make it go away. Washington insiders who have worked on the antitrust investigation echo many of the same complaints cited by Microsoft's frustrated software competitors, charging Redmond with deception, stonewalling, and arrogance.

According to a Senate Antitrust Subcommittee staffer, "There is no comparison between Microsoft and Netscape on the lobbying front. The problem is, Microsoft still thinks everybody is dumber than they are."

Take, for instance, the high-profile row over Microsoft's exclusivity agreements with ISPs. Shortly before Bill Gates testified before the Senate Judiciary Committee last March, Microsoft announced it would drop a contract provision that prohibited partner ISPs appearing in the Windows 95 desktop "sign-up wizard" from promoting competing browsers.

The concession led the Senate to believe the matter was settled, but Microsoft neglected to mention that the Goliaths of Net access – America Online, CompuServe, and AT&T WorldNet – were not included in the new arrangement. Instead, the three services were tucked away in a separate folder on the Windows 95 desktop, where they remained bound by exclusivity provisions.



The lobbying game is easy to play: Just add cash. But Netscape came out on top because money alone doesn't buy DC influence.

Senate staffers were livid when they discovered the half-truth several weeks later, and Gates exacerbated the insult when he wrote a letter to Judiciary Committee chair Orrin Hatch (R-Utah) in which he maintained that all ISPs promoted with Windows 95 – the Big Three included – were no longer required to exclusively promote Internet Explorer.

Netscape, meanwhile, has done a much better job of making friends and influencing people – an accomplishment that can be traced directly to CEO Jim Barksdale. Having previously served as chief executive of Federal Express and president of McCaw Cellular Communications, Barksdale cut his teeth at companies that skillfully manipulated regulatory structures to pry open captive markets. FedEx, for example, is a master of the lobbying art, having used its formidable clout to keep the US Postal Service, labor unions, and the Federal Aviation Administration at bay. Barksdale cheerfully acknowledges that these experiences taught him how valuable a strong Washington presence can be to an underdog player surrounded by larger competitors. No surprise, then, that during the past two years Netscape has poured almost \$1.7 million into the lobby till.

Netscape "has been very effective" in helping Congress pursue its antitrust investigation of Microsoft, says Jon Liebowitz, minority counsel to the Senate Antitrust Subcommittee, who singles out Barksdale for praise, adding, "He's more than just a talking head. He's very substantive."

Netscape has fared better than most tech concerns simply by demonstrating a little bit of DC street savvy. Instead of blustering, the company has pressed its point firmly and consistently – without going too far.

Microsoft's woes, meanwhile, are prodding the industry to pay more attention to events in the capital. As a sequel to the Microsoft case, the Federal Trade Commission has filed suit to halt Intel's allegedly anticompetitive practice of withholding technical data from some computer manufacturers. Further over the horizon, there are occasional murmurs that Cisco could also find itself in the government's antitrust crosshairs during the months ahead. It may be true that only the paranoid survive in the high tech industry, but in Washington, paranoia just doesn't have the same kind of cachet. ■ ■ ■

Will Rodger (rodger@worldnet.att.net) is Washington bureau chief for Inter@ctive Week.

Washington wonks echo many of the complaints cited by Microsoft's high tech foes. They charge the Redmond gang with deception, stonewalling, and arrogance.

NET SUBSIDIES

Fighting over the Kids

A new federal program that doles out megabucks to connect schoolchildren to the Net in every congressional district in the US should be the toast of Capitol Hill. But it hasn't worked out that way. Instead, Republicans fear that the multibillion-dollar "e-rate" subsidy plan looks like the first plank in Al Gore's 2000 presidential bid.

A few years back, lawmakers agreed that phone users – who already subsidize basic telecom service in rural and poor areas – should also chip in to bring the Internet into classrooms and libraries. After the Telecommunications Act of 1996 was passed, the Federal Communications Commission established a nonprofit entity called Schools and Libraries Corporation to manage and implement the E-rate program by collecting up to \$2.25 billion a year from the telcos and, ultimately, their 95 million customers.

Republicans have cried foul. Senator John McCain (R-Arizona) blasted the FCC for paying a politically connected lawyer \$200,000 a year to run the corporation. Senate Appropriations Committee chair Ted Stevens (R-Alaska) has peppered agency officials with questions about "excessive spending levels," and House Speaker Newt Gingrich called the plan a "Gore tax." The GOP also found an unlikely ally in a coalition of consumer groups who oppose AT&T's and MCI's plans to pay for E-rate by adding surcharges to some long distance calls.

FCC chair Bill Kennard has agreed to revamp the program's administrative structure and adjust allocations, but he is determined to keep it alive. With inner-city kids trailing suburban students in Net access, he says, "we've got to keep the program moving forward." – Aaron Pressman

DIGITAL SIGNATURES

Smudged

Digital signatures are a key component of the Internet's security infrastructure – which is precisely why the banking industry wants to promote their use. While several congressional lawmakers have floated proposals to clarify the legal status of online authentication systems, a bill by Republican Senator Bob Bennett of Utah (below) is in the lead so far. Dubbed the Digital Signature and Electronic Authentication Law of 1998 (S 1594), Bennett's bill would allow banks and other financial heavyweights to use electronic authentication from any customer or business.

Consumer groups complain that S 1594 would allow big banks to discriminate, allowing some parties to use digital signatures while others are left to rely on pen and ink. Moreover, Bennett's bill does not hold banks responsible for losses caused by security failures. Privacy groups, meanwhile, aren't much happier. The Center for

Democracy and Technology says the bill could create a centralized data bank that will allow identity theft to flourish. At the same time, CDT warns, the data bank could be a precursor to national ID cards.

Any legislation may be premature. Now that more than a dozen states have enacted their own digital-signature laws, "the states are functioning as policy laboratories," says CDT's Alan Davidson. "It makes sense to continue that kind of organic experimentation." – Aaron Pressman

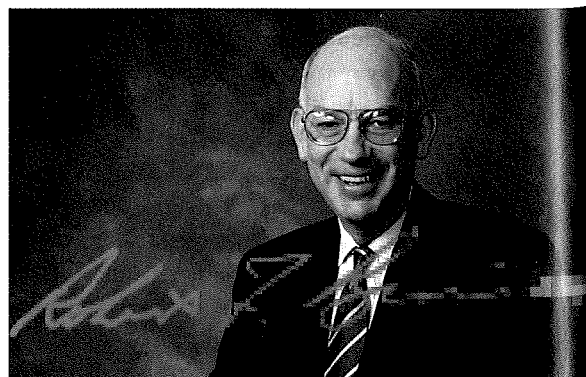


IMAGE TOP: CHRISTOPHER LITTLE/OUTLINE



FREE SPEECH

See No Evil

Donna Rice Hughes is no stranger to the media spotlight. Long the nemesis of Internet free-speech activists, the tele-genic communications director for the antipornography group Enough Is Enough has also taken heat from conservatives who complain that she isn't doing enough to protect children from online smut. Both sides will probably have more to gripe about this September, when evangelical publisher Baker Book House releases her new title, *Kids Online: Protecting Your Children in Cyberspace*. Describing herself as a Net advocate, Rice Hughes hopes parents will turn to her opus as an awareness and resource tool. "It isn't an agenda book," she says. "I think it achieves a necessary balance." – Todd Lappin

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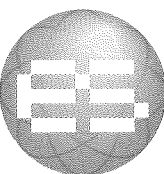
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Bit Players

From mom-and-pop shops
to telcos on ISP buying sprees,
everyone wants a piece of the access.

By Matt Richtel

Mike Tarczewski knows an opportunity when he sees one. Say, used cars. In 1987, while he was a senior at the University of Wisconsin, Tarczewski started brokering trades between auto dealers. His venture netted US\$20,000 in pocket change.

Say, bottled water. Just out of college, Tarczewski heard about a little craze called home water delivery. He used his car-trading profits to start Absolute Spring Water. Five years later the company was a qualified success, grossing some \$400,000 a year before Tarczewski sold out to a local competitor.

Or, say, the Internet.

Two years ago Tarczewski didn't know cyberspace from a sluiceway. But in September 1996 he and a friend launched Aero Internet, one of several fledgling Internet service providers in greater Milwaukee. Today Aero Internet has a modest 1,200 dialup customers, hosts a growing list of Web sites, and holds Tarczewski's unbridled attention. At 33 he's spending his days cold-calling prospective clients and his nights on tech-support triage.

Tarczewski readily admits that he's not like the whiz-bang tech-heads who founded this industry, but he's sick of hearing how you have to have spent your prom night at home playing *Tetris* to win in the ISP business. He considers Net access

fundamentally a service industry. It's not just for bit-heads, and it's not brain surgery. It's used cars, really. It's bottled water.

"Used to be only a techie could do this," Tarczewski says, pausing between phone calls at Aero Internet's dilapidated office in downtown Milwaukee. "Now entrepreneurs are the guys going after it. I can buy a rack of modems and hire the guy with the pencil holder to be my brains."

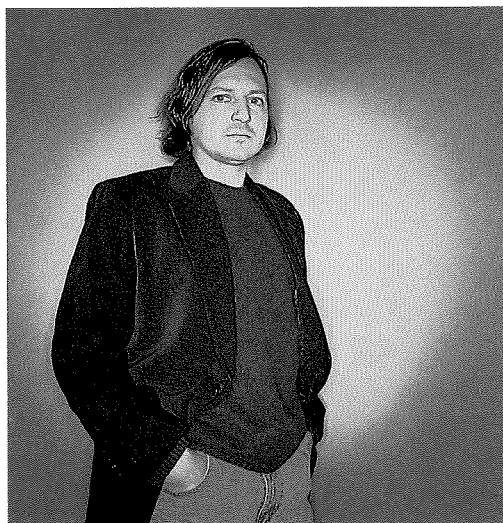
"People don't realize how big the Internet is going to be," adds the English major turned entrepreneur. "It's going to be everything. Period."

A woman in the Milwaukee airport makes one unsolicited plea: Don't describe us as fat. Don't make it sound like

Milwaukeeans eat cheese and sausage all the time.

Please, lady, we can take only so much literary license. Face it - this city is to calories what Philadelphia is to freedom.

But in 1998 Milwaukee is notable for another reason: In flyover land, at least, it represents the typical Internet market. Competing for monthly access fees from its increasingly wired populace are several dozen small ISPs and five big guns - America Online, AT&T, GTE, MCI, and Ameritech, the local phone company. Meanwhile, it's increasingly easy to



Mike Tarczewski sold cars. He sold bottled water. Nowadays, he sells Net access.

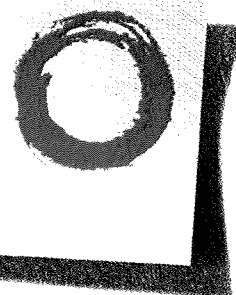


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get into the game. For less than \$20,000 an entrepreneur can buy a couple of servers and a dozen modems, lease a T1 line to hook the whole thing to the Internet, and hang out a shingle. (ISP veterans say that it's probably wiser to start with at least \$120,000 to have a fighting chance.) Indeed, during the last two years the number of ISPs in the United States has exploded from almost 1,500 to nearly 4,500. Their founders are setting up shop in bedrooms and garages – and mortgaging homes and futures – to own a bit of the next big thing in utilities.

The story of Milwaukee and several of its workaday Net entrepreneurs – Tarczewski among them – mirrors the story of the national ISP market itself. They are bit players in the historic market boom, and they are like hundreds of others leading start-ups across the country.

It's a cool Sunday afternoon in August, and Bob Mahoney, the Internet's 800-pound gorilla in Milwaukee, sits in his living room reminiscing. He has more to reminisce about than most.

Mahoney got into the connection business in 1983 when he launched a bulletin-board

ExecPC's success is in part attributable to Mahoney, who's known for an easy smile – a grin, actually – and who looks like a guy who would give you part of his sandwich. To launch his BBS, in 1983 Mahoney hooked an all-aluminum 1200-baud Hayes modem to a 4.77-MHz 8088 IBM PC and a 30-Mbyte hard drive, which at the time was the largest commercially available in the US. He started with primitive RBBS software and one phone line. Within 10 months Mahoney needed to add four phone lines to meet demand. The trouble was, there was no effective multiuser software on the market, so he had to write it himself. It took him nine months to perfect the service, and he nearly went bankrupt trying.

Over the years he added more and more hardware, software, and phone lines, which eventually began to create such a buzz and consume so much room in his ranch-style home that the frugal Mahoney was forced to buy an office. By 1993 his ExecPC had 280 phones lines and 25,000 regular callers. "He became, without question, the biggest computer BBS for a number of years," says eSoft chair Philip Becker, a fellow bulletin-board, service trailblazer who helped found

7,800 modems, 7,200 of which are 56K; 30 routers (the most expensive of which runs \$85,000, although the typical cost is \$2,500); and 100 servers, ranging from NT servers to those that run operating systems like Linux and Sun Solaris. The company's 35 switches connect the routers, two T3 lines – which each cost about \$20,000 per month – and 250 T1 lines that run \$450 to \$1,100 each.

"A strong regional ISP probably will be able to support the changes," Mahoney muses, "but the smaller ISPs are gone. Gone. They can't afford to roll out the technology."

Today many ISPs serve only local communities, but those that aspire to something greater have no shortage of heroes. There is Doug Humphrey, for example, who started Digex out of his basement in 1991. The company eventually went public and last year was sold to Tampa, Florida-based telco InterMedia Communications for \$175 million. There's Charles Brewer, who founded MindSpring in his apartment in 1994. Today the company has nearly 341,000 dialup customers, and the Atlanta-based organization is negotiating a Sherman's March in reverse, having purchased 23 dialup-subscriber accounts from smaller ISPs over the last 18 months. There's William Schrader, who helped found PSINet, which recently turned down a buyout proposal reported at \$400 million. Or Lance Ahern and Matthew Mannhardt, who started Internet Alaska with a handful of modems in 1994 and reported \$6 million in revenue for fiscal year 1997. With plans to double that figure in 1998, the owners have announced they'll start liquidating shares.

Given the rags-to-Internet-Rockefeller stories, it's no surprise that the hottest topic of conversation at last year's ISPCON, the annual Internet industry trade show, was how much an ISP should anticipate getting in a buyout offer. These days an ISP can expect to sell each dialup customer for \$150. If a provider grows to 3,000 dialup customers – the median size for an ISP – that comes to about \$450,000.

Beyond that, many small ISPs report that they are now turning a profit. "It's not like I can retire yet, but we're making money," says Hank Mollenauer, operations manager

During the last two years the number of ISPs in the US has exploded from almost 1,500 to 4,500.

service called ExecPC, which at one time was the world's largest BBS. He's been in full stride ever since. Now Mahoney runs ExecPC the ISP, which, pound for pound, is one of the most successful providers in the country. It has 68,000 dialup customers and adds as many as 5,000 a month.

Those numbers aren't astounding compared with, say, AOL's more than 12 million customers or ICG Netcom's 650,000. But consider this: ExecPC has virtually no debt, a sterling reputation, and an astounding 30 percent operating profit. It also dominates the Milwaukee market.

"It's like AOL is across the country," says rival Mike Tarczewski. "People here think the Internet is ExecPC."

BBScon, the annual trade show for the BBS industry. "He was a pioneer."

Then he had to start over. When Mahoney decided to get into the ISP business in 1994, ExecPC began the technology reinvestment chain again with 14.4 modems, then 28.8, and in 1997 it purchased 5,000 new ones that run at 56K. Mahoney's modem expenses last year: \$2 million.

But the new modems are just the beginning of ExecPC's infrastructure. Mahoney, despite his success, fears he won't be able to keep pace. "Who knows? Maybe there will be standardized access through a really high-speed channel – cable modems, the phone company, wireless, microwave, or satellite," he speculates. To date the company uses



for Access Internet Communications in Cupertino, California, an ISP with slightly more than 1,000 subscribers.

There's just one teensy catch: Many of the ISPs, perhaps Tarczewski's among them, will soon be out of business. It's not because they lack technical skills, although that fact might expedite matters. No, the hard reality is that the ISP market is on the cusp of consolidation. Within the next few years it will surely favor economies of scale: massive infrastructure and investment, and large, regional, and national providers.

At least that's the prophecy of many of the industry's leading observers. These naysayers insist that they're not pulling the dire vision from a hat - or even a crystal ball. They say it's foretold by

history. Take 1893, when Alexander Graham Bell's patent wore out. Within three years the number of telephone companies grew from one to 6,000. Chaos ensued.

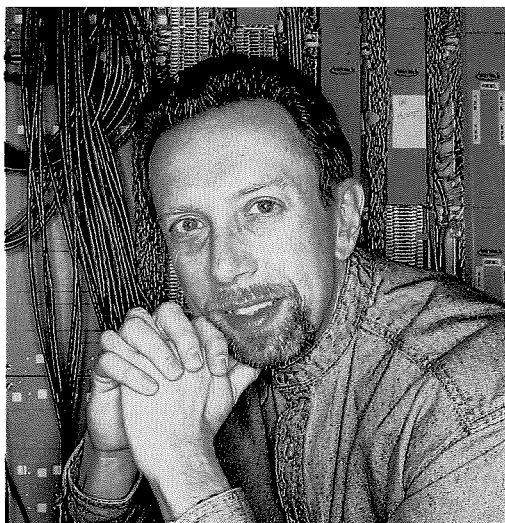
"Everybody and their brother was opening a telephone business and trying to wire their town," says eSoft's Philip Becker.

At the turn of the century AT&T figured out how to economically carry telephone service over telegraph lines, and it voraciously began acquiring local phone providers. Finally, the government stepped in, seeking to regulate the industry to help provide order to an increasingly pervasive service. So, once again, there was one primary company - AT&T - and it reigned supreme until the birth of the Baby Bells in 1984.

Similar patterns of explosion and consolidation have occurred in radio, television, and innumerable other industries, technology related and otherwise. "It's obvious," says Eric Paulak, research director with the Gartner Group. "If the ISP market doesn't consolidate, it will be unlike any market in history."

Paulak, while perhaps not known by name, is reviled in concept throughout the industry. He is the author of an oft-quoted report that projects that within five years, only 400 to 500 ISPs will remain in the US. Paulak says he already sees ample validation of his prophecy. Over the past year and a half, for example, ICG acquired Netcom, GTE purchased

Net pioneer BBN for \$616 million, and WorldCom acquired MFS Communications, owner of UUNet. In January, Princeton, New Jersey-based RCN purchased two East Coast ISPs and, with the scratch of a pen, suddenly owned a 325,000-subscriber



Bob Mahoney represents a rare combination – BBS pioneer businessman and bithead.

base. RCN, a so-called full-service telecom provider, hopes to couple Internet and phone service with cable television access.

And the phenomenon is not limited to the US. WorldCom, now the largest provider of Net access to businesses, has also spent an estimated \$30 million to acquire NLnet, the Netherlands's largest provider, and Australia's largest ISP, OzEmail, recently paid about A\$25 million (US\$16 million) to take over its rival, Access One.

Tarczewski and his brethren can take solace, however, that Paulak and other consolidation advocates have their vociferous detractors.

"They're morons," says Jack Rickard, editor of the industry bible *Boardwatch* magazine, who points out that he has seen only 60 ISPs go out of business or be forced into a merger during the past year.

William Schrader, PSINet's president and founder, seconds him: "I can see there being three to four times the number of ISPs there are today."

Those who believe that the market will continue to expand say Internet access will not follow the utilities model, but will be more like the restaurant business: Consumers will prefer neighborhood or regional service (read: local restaurants), while a handful of national providers like America Online (read: McDonald's) will thrive but not dominate.

Philip Becker of eSoft points out that even the telephone-business analogy offers some hope: Although the industry consolidated dramatically and was dominated by AT&T, some 3,000 small phone companies lingered throughout the years.

AOL argues that Internet access is not a pure service industry. The company projects that the market will consolidate but that it will favor medialike companies, not utilities. Presently, fully 60 percent of Internet users get access from a provider that combines

connectivity and content, be it AOL, Prodigy, CompuServe, or The Microsoft Network. "Nobody cares about their power company," says Barry Schuler, president

of interactive services for AOL, "but people love media companies."

For now Schuler will find no retreat from other ISPs, particularly in the most saturated markets. As of April at least 576 ISPs operated in California, 273 in Texas, and 265 in Florida. Other hotbeds are New York (231), Illinois (181), and Ontario (148). Most large cities have several dozen providers, among them the individual players - like Tarczewski and Mahoney - whose founders are fiercely certain that there's plenty of room. In other words, most communities are like Milwaukee.

Two days later Mahoney is back at the office, moderating a discussion among some of his generals. The topic is whether ExecPC should cut its prices for hosting Web pages, which include a domain name along with a Web site. Jessie, the yellow Labrador, is laying nearby on her back with her legs sticking up in the air.

The company has recently lost contracts for six Web pages. It's a drop in the bucket



for ExecPC, and some of the generals don't think it's worth getting too worked up about – particularly since the company adds nine new Web pages a week. Now the company charges \$50 a month for a Web page and 10 Mbytes of disk space. It is clear that Mahoney wants to drop the price and increase service. The others resist: They're inclined to maintain a comfortable profit margin. "We should be figuring in some for our raises, too," one says.

Mahoney pushes. The direct cost of the package before overhead is \$8.60. He more than doubles the number to be safe: The cost will be \$25 for 10 Mbytes of Web space and five POP boxes, which are email addresses. "This is a long-term plan," says Mahoney. "This is how we leverage one side of the business to give the other side a boost."

The generals grudgingly accept his analysis. Jessie waddles out of the room. (Several months later ExecPC settled on a \$30 rate.)

The bigger picture is this: Across the country, ISPs are scrambling to find other business to supplement dialup access. There are three such complementary opportunities: designing Web pages, hosting them, and leasing dedicated Internet access to corporations.

An ISP can make **\$900 a month** leasing a T1 line to a business. **Sure beats \$19.95** for serving **dialup** to neophytes.

Dedicated access may be the most commercially promising service. An ISP can sell a dedicated 64K ISDN line for \$150 a month or a 128K line for a monthly fee of \$290. Or it can make \$900 a month leasing a T1 line to a business. That sure beats \$19.95 or less for providing dialup access to some needy Internet neophyte.

This could be the business of the future for small – even regional – ISPs. "We're seeing specialization happen," says Harry Fenik, vice president of Zona Research, an Internet market-research firm. "This may actually give some hope to ISPs in the next year." Fenik claims that the market appears to be bifurcating: Small ISPs will serve local businesses with Web-design and Web-hosting

services, while the big-money national players will serve as utilities. "It's time to start looking at pure access as the moral equivalent of the phone company – oh, and by the way, it might just be provided by your phone company."

Mahoney concurs: "We have to have alternate plans to keep us going. I have one theory that says dialup will last another five or six years. I have another theory: In two or three the small regionals will die."

For all the traits ExecPC shares with ISPs in general, it is unusual in at least one key regard: Mahoney himself. He represents a rare combination – he is both businessman and bithead.

Generally speaking, ISP owners fall into three broad categories: the purebred geeks, the MBAs with few technical skills, and the rare hybrids like Mahoney. The bitheads came first, emerging with the Internet itself in 1993 and 1994. They migrated to the Net after running BBSes, which demand similar technical skills. Today some 60 percent of ISP owners are former BBS operators. The trouble is, many of these players lack commensurate business skills, and they're struggling. They know their Unix and their

email shell accounts, but they can't balance their bank accounts.

The next wave of ISP entrepreneurs emerged in 1995 and 1996. Like their BBS brethren before them, they primarily are bitheads who are thrilled that a new business niche fits their technical interests. Among the first ranks are the few geeks who also pass for veteran suits.

The last big wave – the most recent one – belongs to the MBAs, the opportunists and gold rushers. They are the entrepreneurs, like Tarczewski. They don't see circuits and modems and connectivity when they look at an ISP. They see expenses, revenue, and balance sheets. They see widgets. They see bottled water.

The office of Mix Communications is a smoke-filled sarcophagus, a cavelike basement in a colonial office building not far from ExecPC's quarters. Here, Mike Anderson has poured his heart and soul into his ISP business, and it's killing him.

"Oh my God," Anderson says – mostly to himself, partly to his newly arrived visitor. "I have 15 minutes, then I just have to go."

Anderson explains that he's got a sales appointment. Ordinarily, Mix's 28-year-old owner wouldn't bother with sales calls, but last week he fired his entire three-person sales staff. "They weren't pulling their weight," says Anderson, who wears a white oxford shirt, a red tie – and every fiber of his emotion on his sleeve. "I wear so many hats now. I do accounting, legal crap, billing. I'm just trying to straighten this place out." Anderson plops down in his office chair, lights up a Marlboro Light, and proceeds to lose track of time.

See, it is not easy for him to tell the story of Mix Communications – an ISP he has grown to a more-than-respectable base of 4,500 dialup customers – and of the forces of evil and capitalism conspiring to destroy it. Before he bought the company in June 1995 he weighed 225 pounds, worked out twice a day at the gym, and clearly was not the nerd next door. Now he tips the scales at 160, spends 16 hours a day at work, and has survived a nervous breakdown.

Anderson's air of melodrama may add Technicolor to the ISP story, but he echoes a common refrain. ISPs nationwide report that it's no simple task to find qualified technical help. Put it this way: No college or high school teaches ISP 101. In addition, the technology changes so rapidly that a technician trained vocationally or on the job in one area may not be qualified to take on the next technology.

"We have the hardest time finding good people," says Roger Marquis, who owns Silicon Valley's Roble Systems. "We have to pay guys \$60 or \$70 an hour who have three or four years of Unix experience." At Mix Communications, a handful of twentysomethings who sit among drained Mountain Dew cans and fast-food wrappers earn \$10 an hour.

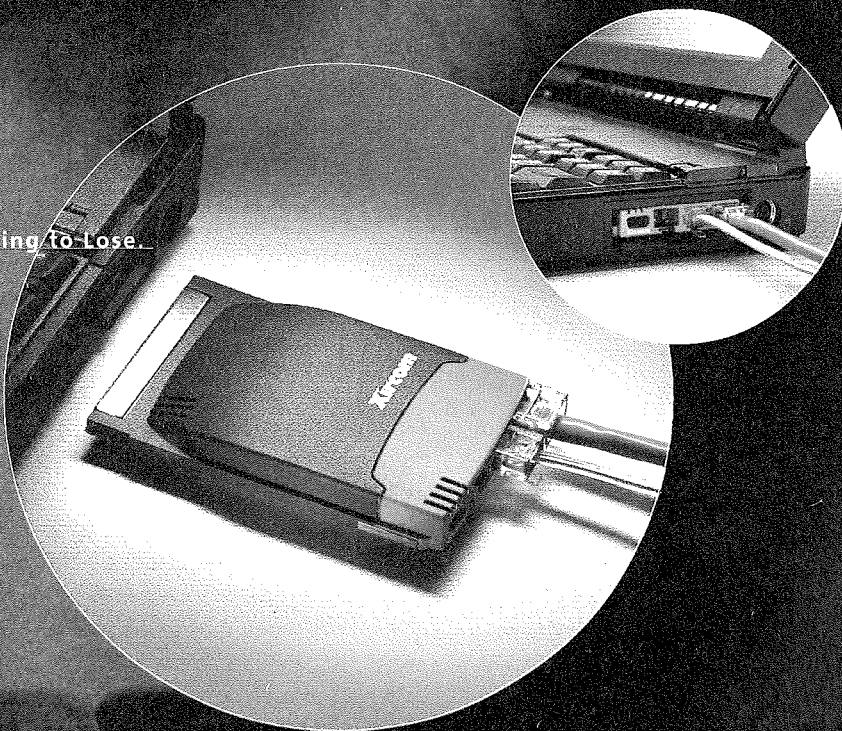
All that effort to keep up with the technology contributed to Anderson's major

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emotional breakdown last year. All that, plus the phone company. It wasn't that the telco was late on a job, but that it was early. "The phone company moved its install up a week. I hadn't slept. I just got ragingly ill," Anderson says. "I was crying my eyes out. I lost it."

If you want to see the owner of an ISP start to cry, just say the magic words *phone company*. To ISPs the local telco is the great Satan, an unresponsive, bureaucratic monolith. Stories are legion of phone companies failing to deliver new lines over billing conflicts, letting downed lines linger for hours, sending out unqualified technicians.

The owner of a small ISP in Mountain View, California, says he can tell horror stories. One night, for example, his T1 line went down. Pacific Bell ran a test at its maintenance center, but the technician forgot to check the results before he went home. The next technician ran the test again but didn't follow through – and her shift ended. Finally, Pacific Bell sent a technician to the ISP to verify that there was a problem. Which, of course, there was. In the end, the T1 line was down for 17 hours.

"The telcos don't know their own technology," concludes the ISP owner, who requested anonymity. "They're either not well trained enough, or they don't have the interest."

The ISPs also have the perception that the phone companies practice benign neglect because they have a vested interest: They're getting into the Internet business themselves. And, indeed, many telcos have jumped into the ISP arena – some aggressively. The GartnerGroup's Eric Paulak says BellSouth and Pacific Bell have been the most determined of the Baby Bells. In Milwaukee Ameritech launched its Ameritech.com service last winter. Most of the recent multimillion-dollar ISP takeovers have been launched by a brigade of three-letter local phone companies – ICG, GTE, and IXC among them.

"You cannot underestimate the value of the fact that once a month, just about every

household will get a piece of mail from the phone company," Paulak says. "Who else can afford a direct-mail campaign like that?"

Despite his continual run-ins with the phone company – and a litany of other troubles he describes – Mix's Mike Anderson says he doesn't plan to give up. Besides, he already has fared better than most. In the three years since Anderson bought the company, it has grown in fits and starts from 400 dialup customers to more than 4,500. It hosts Web pages for 300 businesses and provides dedicated T1 or ISDN service to a handful of others.

During the same period, some of Milwaukee's not-so-finest ISPs have pulled a Hindenburg. There was Vortex Integrated Services, which had 2,900 dialup customers until a revenue shortage got so bad that it just quit paying its employees. And there was U.S. Cyber, an ambitious ISP launched in March 1995 by local cable magnate

Mike Anderson

has poured his heart and soul into his ISP business, and it's killing him.

Donald Jones (who, at about that time, was named by *Newsweek* as one of the 50 most influential people in cyberspace). A year later, hemorrhaging money, U.S. Cyber dissolved.

Then there were the handful of mom-and-pop operations that never even made the newspaper when they dried up and blew away. The evidence, though, remains on the Internet, where search engines still list links to Milwaukee-based ISPs that are no longer in business.

"I've made so many sacrifices. I lost the woman I loved over this place," says Anderson, his expressive blue eyes filling with tears. "She was a 10-plus, a supermodel. I was so crazy about her."

But she just couldn't understand the vision, he says. She couldn't understand that if he just sticks with it, he could retire at 33. She didn't see that "if you work a hell of a lot now, you can play a hell of a lot later." Which brings us back to Mike Tarczewski.

Why, if the future is so uncertain, are thousands of entrepreneurs jumping in? And why are they sticking with it when they realize how great the challenge is?

Tarczewski considers this puzzle as he shows off what eventually will be his new digs at Aero Internet. He's having the office redone – in fact, he's redoing the entire Aero Internet building, a dilapidated fixer-upper

he purchased in Milwaukee's historic downtown. When he's finished, the office will be cooler than a Milwaukee dawn – off-white couch, 27-inch television, terra-cotta walls. Tarczewski and partner Steven Jordan, a 23-year-old University of Wisconsin graduate, are building the business from ground zero, the way the former once did when he was a water salesman, deliveryman,

and CEO all at the same time. Aero Internet is capitalizing on Tarczewski's strong marketing skills, his innate business sense, and his ability to play hardball.

For example, Aero Internet has an advertisement in this year's Yellow Pages that's the same size, uses the same font, and has the same wording as ExecPC's phone directory ad from a year ago. Bob Mahoney believes this is a cheap tactic to steal ExecPC customers. Tarczewski blames the phone company, which he says designed the ad.

ExecPC also has charged that a phone number in the White Pages that advertised "Executive Performance Computers" rang at Aero Internet offices. Tarczewski counters

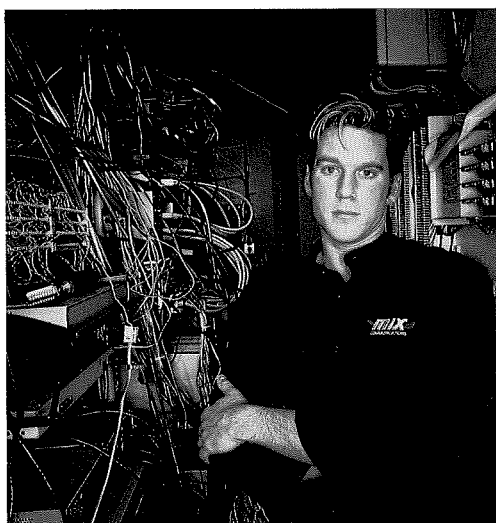


IMAGE: PAUL ELLEDGE

that he once rented space to a now-insolvent ISP called Executive Performance, but he later admits that the line continues to ring at Aero Internet. The upshot: In March, ExecPC filed a lawsuit against Executive Performance Computers and Aero Internet, alleging trademark infringement and unfair competition. "I really can't comment about that," says Tarczewski, noting that his attorneys have yet to formally respond to the suit. But, he adds dismissively of the litigation, "it's silly."

This is how Tarczewski sees the world and copes with life in the Internet business: Everything is going to be all right. The pundits and the naysayers and the history books can say what they like, but you plug ahead and run your business just the way you'd run any outfit - poking around for niches, selling hard, learning enough to get by. "I'm not getting nervous at all," he says, leaning back in his chair, his hands clasped behind his head. "There's going to be tons of opportunity - lots and lots of opportunity and lots of things ISPs can specialize in."

Several months later Tarczewski reports that his earlier impressions have again been validated. He has recently landed several major Web-site design contracts, one for \$7,500 and others for \$2,400. He has hired several new Web designers, has increased his dedicated-access business, and is seeing his dialup base grow by at least 50 customers a month.

Bob Mahoney, on the other hand, reports a change of heart. For a likely price of \$12 to \$20 million, he's decided to satisfy one of the handful of hungry comers looking to get big and narrow the field. The four companies vying to purchase the jewel of Milwaukee access outfits, he says, want to turn ExecPC into what the industry's calling a "super-regional ISP."

"Everybody wants to be a super-regional," says Mahoney, who, after 15 years of BBS and ISP building, is ready to let them have their way.

So what does that leave? Next up: Subnationals. ■ ■ ■

Matt Richtel (mrichtel@nytimes.com) is a reporter for The New York Times on the Web's CyberTimes and a stringer for The New York Times.

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And can you do it by Tuesday?

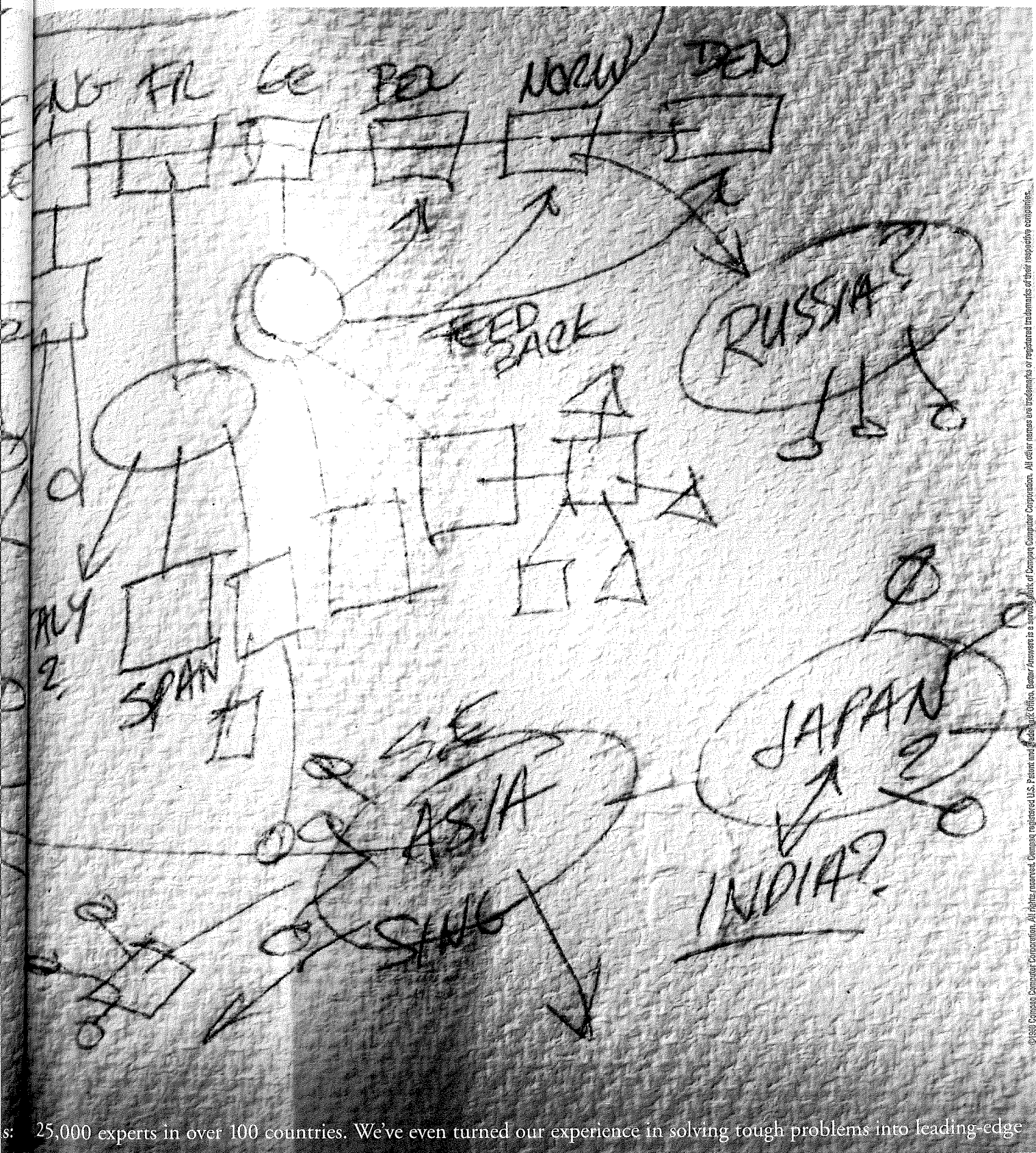
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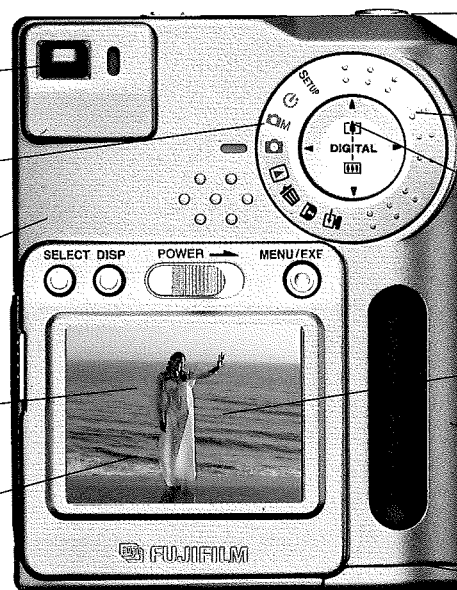
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Jet-Age Bedouins

By Pico Iyer

PHOTO: MICHAEL O'NEILL; RENDERING: MARK OBERHOLTZ



IMAGE TOP: WALTER JABER. FROM LEFT BELOW: GEORGE DYSON'S TREEHOUSE, PHILIP JOHNSON'S GLASS HOUSE, THE COOPER PEDY UNDERGROUND DWELLINGS. PHOTOGRAPHIC IMAGE COLLECTION: OLIVIERO TOSCANI, E. V. NORMAN, RUTH READING, MARK OBERNOLZ, L. A. STOLLER, ESTO PHOTOGRAPHICS, THOMAS CAMPANELLA, PAUL BARDAGY

A different kind of mobile home in South Sulawesi, Indonesia.

in the friends and loyalties and values I carry around with me, as a snail transports his house or the Konjo people of Indonesia bear their shelters on stilts, centipede-like.

More and more of us, I think, are going tribal – either living in the crevices between cultures like jet-age Bedouins, in homes as mobile as our spirits, or hiding out in the corners of the world in flamboyant,

idiosyncratic fancies that look like nothing on Earth (almost). The rock climber's portaledge, Philip Johnson's Glass House, the Cooper Pedy underground dwellings all reflect the whimsy and rebellious

Pico Iyer's most recent book, Tropical Classical: Essays from Several Directions, is out in paperback (Vintage Books).

Arctic abode: the Amundsen-Scott Station at the South Pole.

In China, Hakka homes have one modern convenience: an altar to the kitchen god.

George Dyson's getaway: a beachfront treehouse near Vancouver, British Columbia.

Terrapin Trailways – a Deadhead's psychedelia-on-wheels.

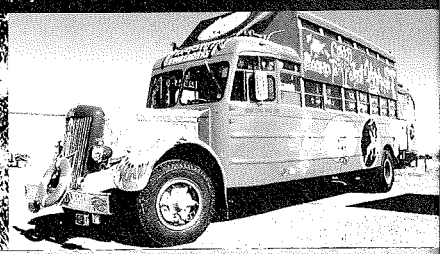
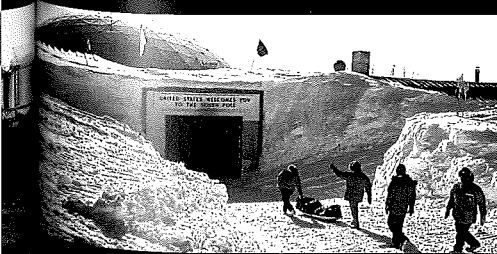




IMAGE TOP: LOU BARTLELL; FROM LEFT BELOW: © 1960 ESTATE OF BUCKMINSTER FULLER/COURTESY BUCKMINSTER FULLER INSTITUTE, SANTA BARBARA; BARRY TESSMAN; HIROYUKI HIRAI; © TAKANOBU SAKUMA

IMAGE TOP: DAN BURTON; FROM LEFT BELOW: DAN BURTON; MARK ERICKSON; BATISTAMOOK STUDIO; JOHN RUNNING/BLACK STAR

Living the high life: Two climbers spent 15 nights in this tent at 2,000 feet in Sam Ford Fjord, Baffin Island, in Canada's Northwest Territories.

energy of people determined to live on their own terms, or bounded by their own premises (as Thoreau once punned). Solar powered, underwater, camouflaged, scavenged – these habitats are not just places to live, but ways to live, in a world that's moving as much as we are.

Much of this tribalism arises from new technologies, which allow us to live more independently, reclaiming some of the freedom of

nomads. Yet in an age of ever greater complexity, we hanker for simplicity – for something basic, portable, and indifferent to the conventional definition of home.

Then why do so many modern constructions echo the oldest dwellings, as if to imply that tomorrow can be a high tech form of yesterday? Rem Koolhaas, the Dutch provocateur, is designing a

Historical futurism: Buckminster Fuller's Wichita House, built in 1946.

Forget sit-ins. Eco-activists stage live-ins to protest logging in Northern California.

Three years after the Kobe earthquake, these shelters, built of paper tubes and sand-filled beer cases, are still the homes of choice for some Japanese.





An octopus's garden for marine-life scientists, the Aquarius undersea lab sits 6.5 kilometers off Key Largo, Florida. Researchers stay under for 10 days at a stretch.

"Generic City" of the future, inspired, he acknowledges, by the simplicity of villages in Thailand, where shelters are furnished with nothing but bamboo, palm leaves, corrugated iron, and fluorescent tubes. Such "liteness" is essential, Koolhaas says, because it's "capable of dealing with anything bound to come along in the 21st century."

Whether rooted in such "global village" huts, or wandering the

planet, Modern Tribal Man is colonizing his dreams with structures that are often as much the product of imagination as of brick. Consider Michael Jantzen's conceptual Southern California beach house of video screens, with TV panels projecting images of the world – or, at least, the Net – into a Malibu living room. Cyberspace has reinvented our sense of habitat by giving us a new dimension to inhabit;

The Aquarius aquanauts, returning home, enter through the wet porch.

Aluminum foil-fiberglass insta-shelters for firefighters.

Castle cheap: an Earthship of old tires and dirt in Taos, New Mexico.

Four walls, a roof, and a deck on Lake Powell in Arizona.





IMAGES FROM LEFT: BELOW: RAPHAEL GALLARDE/GAMMA LIAISON; FROM LEFT: BEL
 LIAISON; PETER T. WELLMAN/STONY STONE; ALAN WEINTRAUB/ARCAID; LORI GRINKER/CONTRAST PRESS IMAGES
 PHOTOS: PHILIP EL GALLARDE/GAMMA LIAISON; FROM LEFT: BEL
 LIAISON; PETER T. WELLMAN/STONY STONE; ALAN WEINTRAUB/ARCAID; LORI GRINKER/CONTRAST PRESS IMAGES

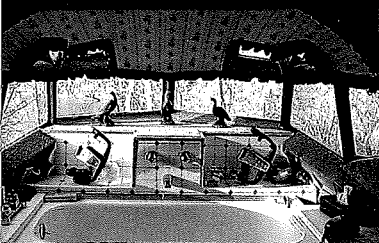
Winging it in Mississippi: Jo Ann Ussery, a 52-year-old hairdresser, passed on a mobile home and converted this Boeing 727 in 1994.

in doing so, it has made literal all our once science fictive notions of seeing the world without leaving the house, or dwelling in a custom-made community with no physical borders. The denizens of the new millennium are living, for good and ill, in the literal, tangible equivalent of cyberspace, in spaces as individual as our passwords, in homes as virtual as our workplaces. If Bill Gates can build a

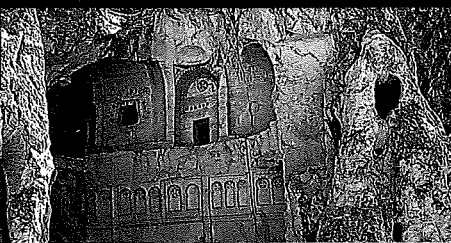
pharaonic mansion "made of silicon and software" — a Web site writ enormous, more or less — why can't we construct homes, and even lives, as private and unlegislated (as solipsistic, too, and removed from all coordinates) as our email addresses?

Wim Wenders set the conclusion of his millennial road movie *Until the End of the World* in an aboriginal cave somewhere in

Ussery's architectural whimsy: a tub in the cockpit.



An ancient hole in the wall in Turkey's Cappadocia district.



The home of the architect known as Bart Prince in Albuquerque, New Mexico.



Cow dung plus elbow grease equals simple shelter in Tanzania.





IMAGE TOP: RAPHAEL GAILLARD/GAMMA LIAISON; FROM LEFT: BEJOY, GREVILLE TURNER/MILGROM, JOJO AGENCIE, PHILIP COSTELLO, EIGHT, THE O AGENCY, ALAN WEINTRAUB/ALCAID, ALEX KALLERBERG

central Australia, in which people's dreams and memories could be projected onto screens; in *Vineland* and *Mason & Dixon*, Thomas Pynchon describes people living above, below, and around the world we know, in parallel states of consciousness. The real world, Don DeLillo's recent magnum opus suggests, is the Underworld, that realm of blood and clan and secrets that exists right under our noses and beneath

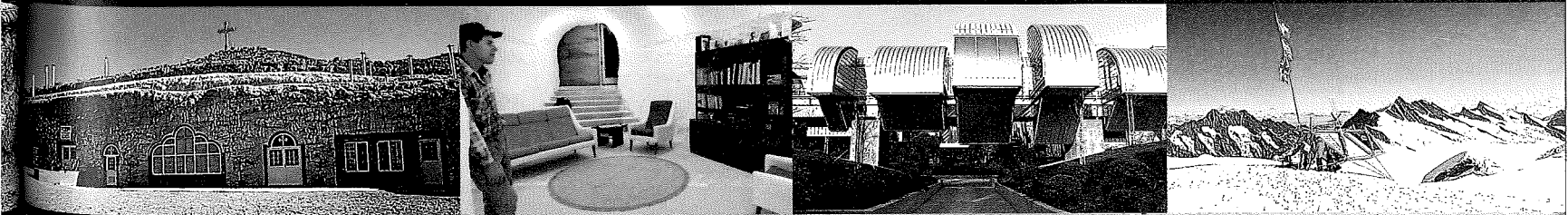
our undifferentiated labyrinths of Holiday Inns and Golden Arches.

Such visions reflect a future of alternate and individual worlds, in which the conformist impulses of old are eclipsed by communities of one. Not that we're living without traditions; we're simply living with fewer constraints and greater choices, building habitats and laying foundations in spirit as much as space. ■ ■ ■

In Coober Pedy, Australia, the residents live, work, and even worship down under — in abandoned mine shafts.

Part modernism, part machine age — the Sidley House in Malibu, California.

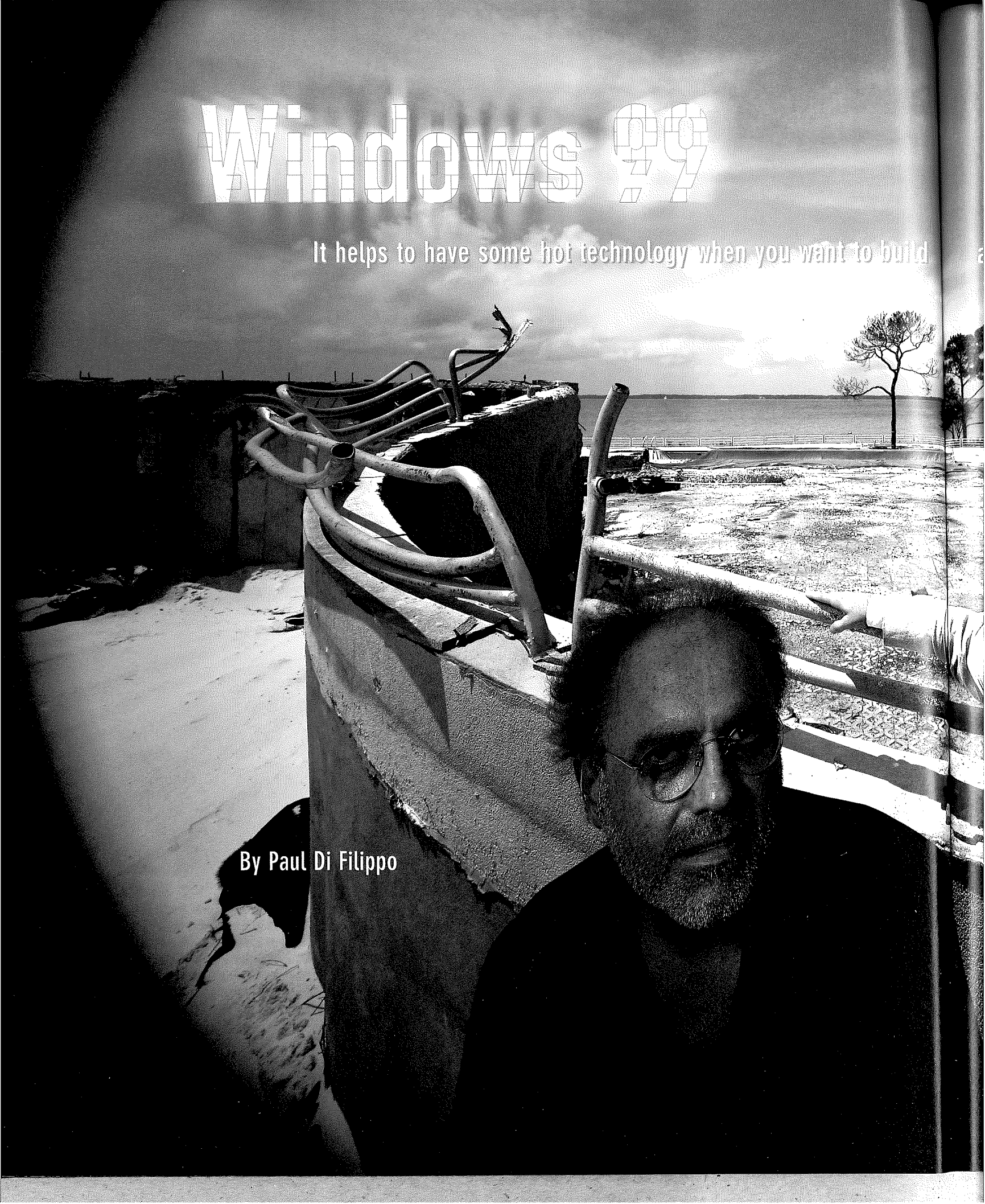
Richard Horden's Ski Haus; portable, solar powered; hot cocoa not included.



Windows 99

It helps to have some hot technology when you want to build

By Paul Di Filippo





a glass house smack in the middle of a hurricane zone.

Picture a 180-foot-long, two-story glass box with the proportions of a stack of Fig Newtons – then raise it all up on stilts. You now have a faint idea of what two architects from Chicago, Ron Krueck and Mark Sexton, inflamed by an obsessive adoration of glass, are building on Florida's Gulf Coast.

Now take that large box and bend it a third of the way down its length at a slight angle. Grab its long north and south exterior glass walls and distort them into convex arcs above and below the house frame, as if the undulating walls were caught just shy of exploding. Carve away to create asymmetrical bays and porches, alcoves and terraces. Fill the interior with a cantilevered study and criss-crossing corridors and staircases, leaving a vast open space. This is the plan Krueck and Sexton devised in response to a request from publicity-shy clients – call them Mr. and Mrs. Fish – for a “simple, elegant, but really cool house with wraparound views.”

On paper, the Fish residence casts off the bulky external barriers of traditional structures. “You won’t notice the frame,” Krueck says. “You should have a feeling of utter freedom from design.” Looking at the drawings leads you to wonder whether the architects aren’t presuming to transcend the limitations of weight and gravity as well. Launched from the architects’ imaginations to be raised like an enormous crystalline dirigible, the house still must be built and anchored 158 ►

Paul Di Filippo, author of the science fiction novel Ribofunk, writes for The New York Times and Interzone.

Smart Parts

A user's guide to out-of-the-box living.

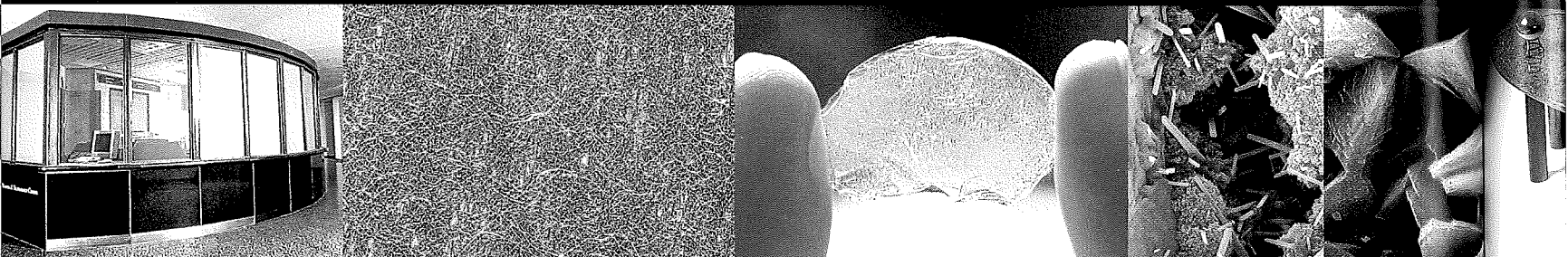
By Mark Frauenfelder

Privacy Glass: Flip on the window, frustrate the spy.

Flectron: tearproof, fireproof, soundproof, electromagnetic-proof metalized nylon.

Aerogel: This Mars-tested material is as light as a feather, but infinitely warmer.

Supercritical cement: normal (left) versus nearly indestructible Supramics.



Liquid drapes

Peeping Toms can blame it on liquid crystal — a substance we associate with digital watches, calculators, and other consumer-electronics products with display screens. LCDs are everywhere because the material does a simple but eminently useful thing: It reacts visibly to magnetic and electrical fields. It has an on color and an off color.

About five years ago 3M (legendary birthplace of Post-it Notes) developed paper-thin, electrically sensitive Privacy Film, based on patents held by Kent State University and Raychem Corporation. Today Viracon, an architectural-glass company, sandwiches a layer of liquid crystals between two sheets of 3M's film, which in turn are held between panes of glass. When electricity is applied to the film, the liquid crystals line up and the foggy material becomes clear. When the current is withdrawn, it becomes opaque again. The result: Privacy Glass. Now you see through it — now you don't.

Viracon: www.viracon.com/.

Bulletproof vestibule

Paltech informational videos feature 200-mph tornadoes, flying debris, bullets, and even a bomb test — but no broken glass. That's the point of Paltech, a hurricane-resistant window material sold by Security First Distributors: Now people in glass houses can throw stones with abandon.

The secret of the shatterproof material

is polycarbonate, a family of plastics 250 times stronger than glass. Hit a sheet of this stuff with a sledgehammer and it won't break. Yet, illogically, the material can be scratched by a key. To protect the delicate surface, Security First sandwiches the polycarbonate between sheets of glass, creating an unbreakable material that weighs half as much as standard panes. The caveat: Paltech is expensive, and — much to the chagrin of our glass-obsessed architects (see "Windows 99," page 114) — the cost of a Paltech palace would be prohibitive. *Security First Distributors:* www.securitywindow.com/.

It's metal! It's fabric! It's Flectron!

George Beylerian knows fabrics. And he loves metalized nylon. The founder of an obsessive, almost fetishistic art resource and gallery in New York City called Material ConneXion (www.materialconnexion.com/), Beylerian first encountered the substance at the Tech Textil show in Germany last year. The lightweight pliable fabric has the feathery sheen of a FedEx envelope, because both materials are made by bonding fibers in a random configuration, rather than weaving them.

Metalized nylon — as the name implies — consists of thin nylon fibers coated in copper or silver. "It's a hybrid material with the appearance of paper and the properties of a fabric," he explains. "It's tearproof and fireproof." More important,

the fabric shields spaces against electromagnetic interference that would damage electronic equipment and erase digital data. Manufactured and sold as Flectron by Advanced Performance Materials, the substance is used in door, window, screen, and partition construction. *Advanced Performance Materials:* www.apm-emi.com/.

Out of thin air

It started with a wager: During the 1930s, a researcher named Stephen Kistler bet a colleague that he could make a gel that didn't shrivel up when it dried. He won the bet with aerogel, a ka frozen smoke. Kistler's flammable recipe was so dangerous, however, that the material didn't break out of R&D until a UC Berkeley professor discovered a safer production process 50 years later. Now, in the '90s, it is finally being commercialized.

Made from a maze of silica strands only one one-thousandth the thickness of a human hair, the substance is 95 to 99 percent empty space and weighs only three times as much as air, yet a one-pound block can support half a ton. Why should you care? Because aerogel is an amazing insulator: A thin sheet of this nearly translucent material insulates better than yards of cotton-candy-colored fiberglass batting.

Aerogel kept the electronic innards of the Mars Rover toasty warm, even when Martian surface temperatures dropped to

minus 88 degrees Fahrenheit. Although aerogel isn't fully transparent (something researchers are working to correct), it is already used to produce windows and skylights that insulate better than the surrounding walls. In Ontario, Canada — where people don't have to be told why they should care about insulation — AMI, a start-up, is planning to produce 250,000 square feet of aerogel a year to replace local-standard three-pane glass windows, which still don't keep the frost out.

Manufacturers have a favorite trick to show aerogel's heat-holding prowess: They place a hand against a thin sheet and apply a blowtorch to the other side. No sweat. NASA: snail.msfc.nasa.gov/station/train/Aerogel/HOUSEOFFUTURE.HTML.

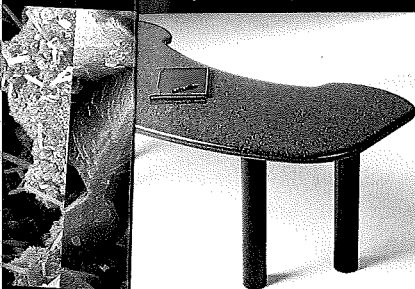
Building a greater wall

Cement surrounds us — in foundations, floors, and interior walls. First used in ancient Roman constructions such as the Pantheon, then lost during the Middle Ages and rediscovered by English engineer John Smeaton during the 18th century, cement is one of the oldest building materials and one of the most common. The substance is formed by crushing, blending, and heating limestone and clay until it almost fuses. Then it is ground again into a fine powder. When mixed with water, the silicates and aluminates in the ingredients undergo a chemical reaction and begin to harden into a solid

People don't But in an age in which we can make diamonds out of peanut butter, out titanium why is your habitat built of the same types of materials used by your word, thanks eat-grandparents? Because traditional construction materials have a substance of ithstood the test of time. Though houses built of wood and brick may n, our habitats, linter, glass windows may shatter, and shake roofs may kindle, those materials from materials have predictable properties. Worried about lawsuits, architects petroleum and builders opt for materials with a track record.

But there is new stuff out there. Latter-day Merlins, working quietly in

Environment: normal (leaving: making to furniture destructible Supon soy and newsprint.



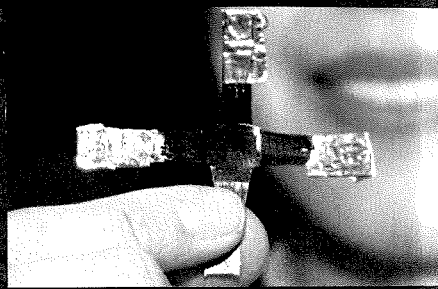
Thermochromic paint: putting temporary art on the walls.



Carbon-fiber reinforced polymer: a new breed of construction paper.



Structural electronics: the brain cell of a smart house.



it. Although mass. But if water permeates the material (something before it has fully set (which can take correct), it is years), the concrete can crack.

In their quest to develop a leach-proof material for storing nuclear waste, Los Alamos National Laboratory researchers created a stronger and more chemically stable cement. The process, based in part on the patents of The Supramics Company, uses high-pressure supercritical carbon dioxide – that is, CO₂ in a state between liquid and gas – to chemically alter the cement and drive out the water. This process transforms it into pure limestone, a virtually indestructible material, in a matter of hours. By comparison, the cement in the Great Wall of China – parts of which were built during the fourth century BC – has not fully hardened, and won't for another 30,000 years.

The Supramics Company: www.supramics.com/.

Vegetable, mineral, material

Sure, soybeans can be transformed into everything from milk to faux filet mignon. But a soy-based building material? In fact, Henry Ford made the first fiberglass-soybean auto body in 1938. And biocomposites have come a long way since then. These materials, composed of renewable or recycled biological substances, are inexpensive, lightweight, and eco-friendly. Take Environ: A slab of this substance – made of soy flour and recycled newsprint – has the properties of wood and the look

of granite. The material, manufactured by Phenix Biocomposites, is harder than oak and can be milled, sawed, drilled, and nailed. Other biocomposites – made from wheat or rice straw or dust from rock quarries – imitate and replace nonrenewable materials or those derived from scarce natural resources. *Phenix Biocomposites: www.phenixmfg.com/.*

Mood paint

This is not the stuff of science fiction or even structural engineering. It's just paint – the home-improvement staple mixed with a thermochromic carbon-based pigment that fades as the temperature rises and brightens as it cools. NASA developed the substance as a coating that would warn scientists when a machine was overheating. Researchers also hoped that the material could be used as an exterior house paint that would darken and absorb heat from sunlight during colder seasons. But the paint is not UV protected and costs too much to affect energy efficiency.

So, for the moment, it's just the stuff of art: Jürgen Mayer Hermann, a German artist, mixed the thermosensitive pigment with latex house paint to create his *Housewarming* installation. When you touch the wall, the color temporarily fades, leaving a sort of negative shadow. Functional? Perhaps not, but fabulous nonetheless. *Henry Urbach Architecture: +1 (212) 627 0974.*

Urban band-aid

Think outside the box of your house for a moment. Think about the habitat at large – towns, cities, and the roads that connect them. According to Antonio Nanni, a professor of civil engineering at the University of Missouri, almost half of the 575,600 highway bridges in the US are structurally deficient or functionally obsolete. But Nanni has a band-aid solution: a carbon-fiber reinforced polymer system. Eight times stronger than conventional reinforcing steel, this composite is formed into sheets and wallpapered over damaged concrete foundations and structures.

Now, think about what the technology can do for the foundation of your house. *Antonio Nanni: +1 (573) 341 4400.*

Faux photosynthesis

Greg Van Patten may be the only materials scientist who claims chlorophyll as his muse. A bioscience researcher at Los Alamos National Laboratory, Van Patten is developing films that could be used to coat roofing tiles. Dyes in the film would imitate photosynthesis, collecting energy from the sun and converting it to electricity.

On a clear day, the sun transmits about a kilowatt of power per square meter. While plants use that energy to convert water and CO₂ into food, Van Patten's tiles can use the energy to power your VCR or Mr. Coffee – and we're talking about hours of video and many pots of coffee. Tradi-

tional semiconductor solar cells collect only a limited portion of the light spectrum, but the Los Alamos tiles are treated with layers of films, each tinted with a dye designed to absorb a particular wavelength of light. A stack of different-colored layers can soak up many wavelengths of light. *Los Alamos National Laboratory: www.lanl.gov/.*

Smart walls

If Thomas Edison is the father of electricity, then Deborah Chung, a professor of mechanical and aerospace engineering at the State University of New York at Buffalo, is the mother of structural electronics. As you might expect, the technology embeds electronic properties into materials so that surfaces will be able to store electricity and will have the intelligence to measure and control climate. Chung's team has built several prototypes.

The breakthrough-within-a-breakthrough: Material – carbon fibers bound by an epoxy matrix – that acts as a metal and a semiconductor. Less expensive, less fragile, and easier to produce than silicon circuitry, structural electronics will allow walls to store energy and act as control circuitry. The carbon fibers can also be used to create smart concrete that will sense and report structural damage. *Deborah Chung: +1 (716) 645 2593. ■ ■ ■*

Contributing editor Mark Frauenfelder wrote "Transformer" in Wired 6.06.

Wired: Why are tech-minded people so interested in your ideas?

Stewart: It is the technological age, but it is still an age of people wanting to know how things are done. My readers think in a modern fashion about old-fashioned values.

Are you of the school that says flaunt your computer equipment, or hide it?

Oh, absolutely put it out in the open. Or hide it in the most effective way possible. My office at home is an office in a closet.

So you hide it?

Well, no, it is always out, except when I am having a dinner party – then I roll the shelves back in and close the door without disturbing anything. I want real practicality and real simplicity. So, invisible, appropriate, and simple, simple, simple.

What's the appropriate color to go with computer beige?

Why are you thinking only of beige? I have a beautiful new black computer with all black components. And, I have a very

beautiful new silver one. I think computers certainly could be more appealing aesthetically and fit into rooms nicer.

Any thoughts on smart houses?

I am restoring a house now

Martha Stewart, as every American knows, is a living brand. In fact, with a 2.3 million-circulation magazine and syndicated column bearing her name, a river of books, and a stream of television shows, Martha Stewart is a force of nature, the most influential person alive in terms of giving shape to our living spaces. She certainly has a knack for articulating our habitat dreams.

And she is way into materials – premium, well-crafted stuff like flower crystallizing kits. But what about liquid crystal displays? Any plans to expand from bed-sheets to spreadsheets? *Wired* caught up with the lifestyle queen on her car phone as she navigated the streets of New York en route to a dinner party.

furnaces, you don't hear refrigerators, you don't hear dishwashers. I am working very closely with all the different companies trying to get them to enter the 21st century with a sense of adventure and silence. It is a very difficult directive.

Besides silence, what else are you after? How about having your refrigerator talk to your stereo?

I don't want my refrigerator talking to me period. I don't want it telling me that I am low on meatballs. I do have a brain.

Do the same design principles you use in your other projects also apply online?

Yes. People respond to a pretty Web site, and they respond to a simple Web site. I don't want talking parrots. I want it to be a gentle, soothing kind of place – functionality has to be good, but it doesn't have to be invasive.

Do you find the Web sympathetic to that kind of soothing?

I want to get across as much information as possible in as

Kevin Kelly (kevin@wired.com) is Wired's executive editor.

short a period of time. I want it to be straightforward – I don't want to open drawers or doors. I hated *Myst*. It was so queer.

So you'd find no use for a virtual walk through a house?

No, it isn't that. I do have plans for being able to wander around a home. But I want to do it in a simple, very beautiful way and a real way, not distorted. You could click on something in a closet and be told what it was and where to buy it.

What about email?

Oh, I have a server in my basement. I am really connected, but I find the software to be abominably inadequate. I complain about it a lot.

Do you find yourself surfing the Net much?

I don't have a lot of time to sit and just sort of fool around. When I get home at 11 p.m., which is normal, I go to my computer to read mail, then answer as much as I have the energy to. I'll usually get my answers in the morning before I go to work, because I have a lot of friends and business associates on the West Coast and in London.

Yet your magazine doesn't give the impression that you are so techie – you don't see computers on the table in your photos.

Why this disconnect?

It is a little bit sparse, I must admit. But they are there if you really look. Besides, there is still a big gap between the 35

“I Do Have a Brain”

But Martha Stewart also has a server in her basement. By Kevin Kelly

that was a 1962 Bunshaft modern. I've gutted it and am now installing silence.

Silence? How do you install silence?

I want to have a silent environment where you don't hear

percent of the public who have computers and the 65 percent who don't. When that fault is fixed, I think you will see a lot more in the way of female users and older people. And yet our readers know that we are technically savvy. More than 50 percent of our correspondence is reaching us by email now, around 130,000 pieces of email correspondence a year. Which is very easy to respond to and very pleasant to receive.

The question of the season: Microsoft monopoly – thumbs up or thumbs down?

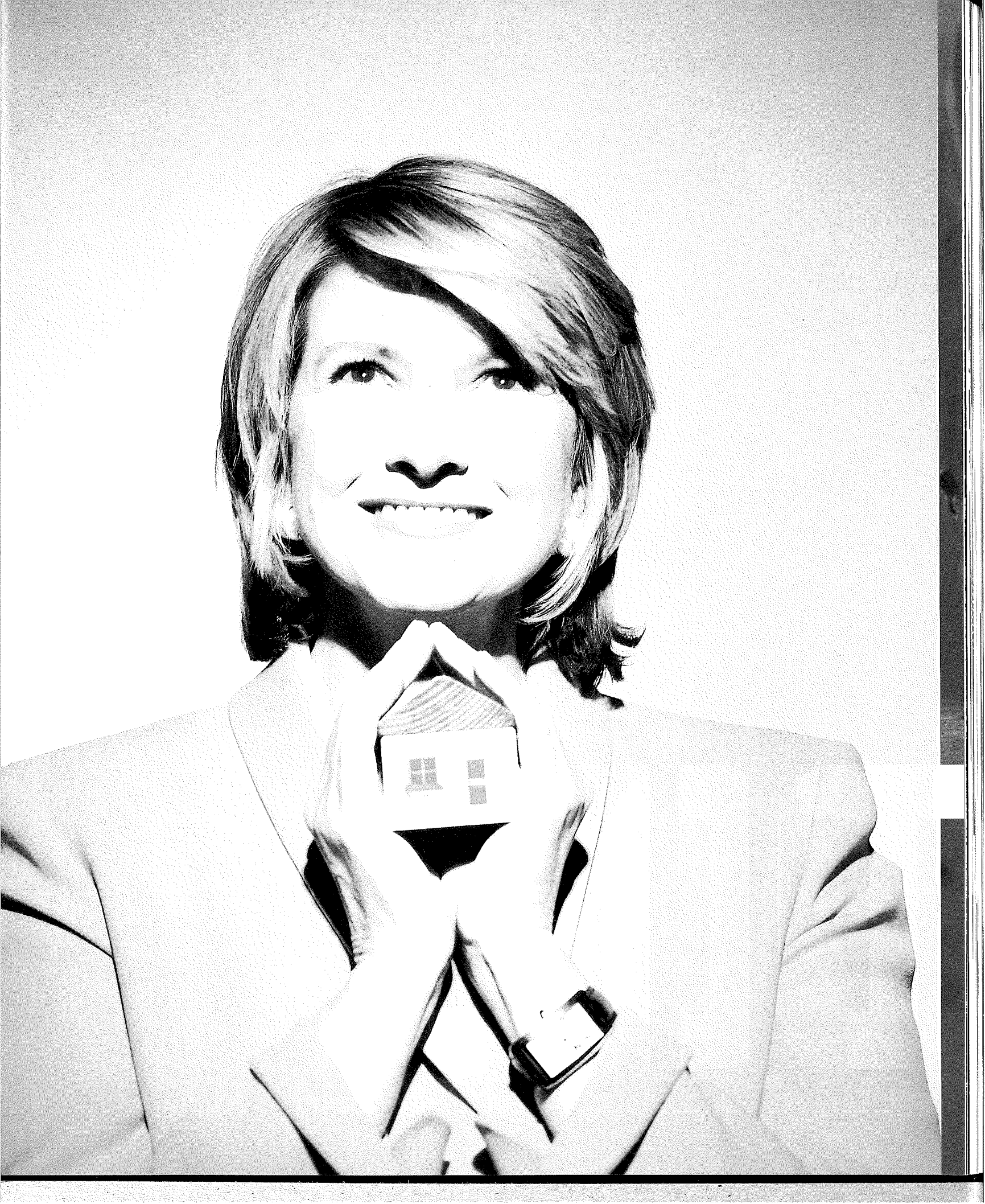
Listen – if anybody who wants to be an explorer or a pioneer has to go through what Microsoft is going through, I feel really bad about it. Man wouldn't have gotten to the Moon, or invented the telephone, if there had been a check at every step of the way. I don't believe in this action at all.

Management guru Tom Peters preaches the “brand of you” – if there is anyone this applies to, it's you. What happens if you get hit by a bus? Does the brand of you continue?

I'm trying to make sure that my brand extension is broad enough that if anything happens, or I decide to check out, it can continue. We have taken the next five years of photographs of me already, so if anything happened to me we have those closets full of photos.

You could have yourself scanned to create a virtual character.

Cloning hasn't worked yet, but I'll be the first. The first human Dolly will be me. ■ ■ ■





DIE,

Forget Asimov's laws, forget R2-D2, forget AI altogether.



ROBOT

These technocidal machines were born to kill. By Charles Platt

On the left stands Buzzcut, a walking robot whose Weed Eater motor drives a byzantine assembly of rods and rubber belts. Three vicious-looking circular saw blades are mounted at the front, another three rotate at the rear, and the whole Rube Goldberg apparatus is supported by eight rubber-tipped aluminum legs.

On the right is KMM, a very different animal, its machinery protected under a rounded golden shell of graphite woven with Kevlar. KMM sports a pair of crablike metal pincers to grab its victims, which it then hammers into submission with a spiked metal tail.

Techno music pounds from giant speakers as the machines are made ready in an asphalt arena. Behind 6-foot sheets of quarter-inch bulletproof glass, banks of bleachers are packed with fans, who paid up to US\$30 admission. The robot owners retreat to safety, clutching their radio-control units. Atop a rickety wooden platform, three judges wearing earplugs signal that they are ready for combat to begin.

Action! KMM zooms forward, snapping its pincers. Buzzcut revs his motors, whirls his saw blades, and starts hopping around on his bouncy rubber feet.

The contest is beyond bizarre; it's inhuman and demented. Imagine a fight between a paraplegic slithering on his stomach with an ice pick strapped to his back, and a hyperactive infant restrained so that he can only jump up and down and bite people. That's the gist of it.

Buzzcut tries to climb on KMM's back and slice it open, but his legs and drive belts get tangled. KMM's deadly tail swings, and its spike pounds one of Buzzcut's green electric motors. There's a bad ripping noise. Smoke rises; soon one motor is out of action, and two of Buzzcut's rubber feet are torn off, forcing him to dance helplessly in circles. Meanwhile, somewhere underneath KMM's rounded shell a linkage breaks, leaving the spike-hammer trailing impotently on the ground – but no matter, the weapon has done its work, and the judges reach their verdict. KMM is the winnah! The crowd roars with approval as sweepers start whisking away the debris.

Now imagine this kind of confrontation repeated in 100 different variations throughout two whole days, and you have Robot Wars, the annual monster slugfest in which lovingly crafted death machines duke it out one-on-one

Some robots are primitive metal boxes improvised by high school students in basement workshops; others are as sleek as race cars, crafted by professional model makers at Hollywood f/x houses. Mark Setrakian, for instance, developed some of the creatures for *Men in Black*; at the 1997 Robot Wars he exhibited a huge steel snake, 13 feet long, that writhed and crashed across the arena, rousing a standing ovation from the capacity crowd.

Why did Setrakian suspend his lucrative business and spend huge amounts of time and money developing this monster? "I like building robots," he says simply.

For Marc Thorpe, it's not simple at all. Thorpe is a bony, worried-looking, 50-year-old model maker who used to work at Industrial

dilemma. Destruction is not by any means a negative thing; when a child builds a sand castle and knocks it down, this does not mean an innate desire for warfare."

In fact, Thorpe goes on, why couldn't robot slugfests steal audience share from contact sports? It's so much, well, psychologically healthier for us to see machines getting clobbered than people. Ideally he'd stage regional events across America, televised on ESPN, leading up to the national finals.

Is he onto something? *American Gladiators*'s musclebound thugs in superhero costumes try to hit each other with tennis balls fired from compressed-air cannons; fans will cheer costumed wrestlers bashing each other with folding chairs. Why not Robot Wars?

Then again, audiences who actually witness the Robotathon may be unconvinced by Thorpe's earnest assurance that the spectacle is benign and irrelevant to real-life warfare.

At the weighing-in session preceding Robot Wars, clusters of nerds show off their killer bots in "The Pit," an area cluttered with folding chairs, power tools, cables, and battery chargers. The hall echoes to the sound of tortured metal and stinks of solder and burning rubber as builders make last-minute mods to machines sprouting spikes, knives, cutting wheels, hammers, and chain saws. To the casual observer it looks like boys with their toys, and the toys are lethal.

"I just don't see the point of it," says Frank Jenkins, an engineer who inspects robot competitors to ensure that they comply with safety regulations. "I have 162 ▶

Contributing editor Charles Platt (cp@panix.com) wrote "Inside Project X" in *Wired* 6.07.

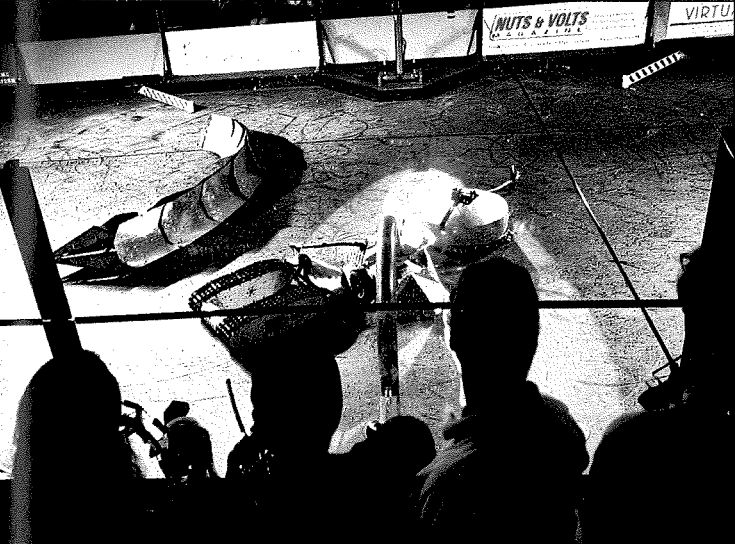
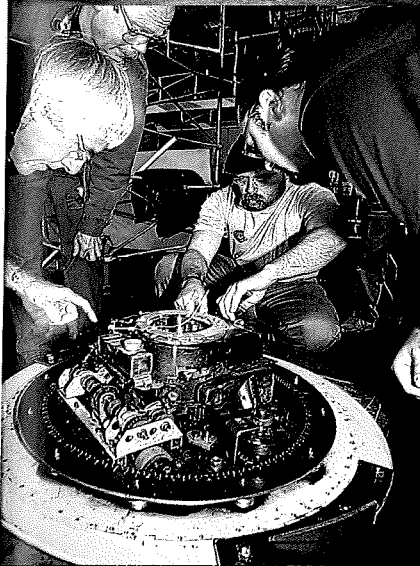
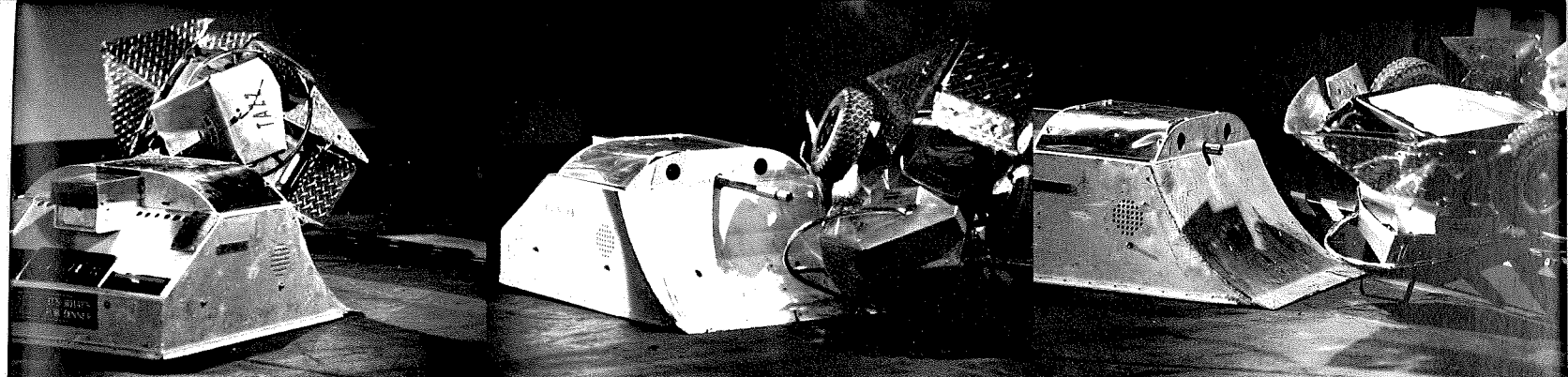
Robot Wars '98

This year's Robot Wars will commence August 14 (when robots are weighed and inspected), with one-on-one combat and mêlées August 15 and 16. All events are staged at Fort Mason Center, a converted waterfront area west of Ghiradelli Square in San Francisco. See robotwars.com/ for special discount rates on advance ticket purchase.

If you're interested in building your own contender, there are four classes: featherweight (10-25 pounds), lightweight (26-50 pounds), middleweight (51-100 pounds), and heavyweight (101-180 pounds). Your robot must satisfy strict and complex safety regulations; email robotwars@aol.com for further details.

and in no-holds-barred mêlées. The concept made its debut in 1994 as an obscure "art event," quickly gathered a fanatical following, and by '97 had spawned a six-week BBC TV series. This year's contests, scheduled to begin August 14 in San Francisco, will feature some 100 participants vying to pulverize each other into scrap metal.

Light & Magic but now describes himself variously as a promoter and a performance artist. He invented Robot Wars, manages it, and justifies it with a long, rambling, philosophical manifesto. "Robot Wars offers a license to celebrate the archetypal elements of life and death without any person or creature paying a price for it," he claims. "It's a theater of survival, a microcosm of our own



Killer apps (left to right from top): La Machine gives the hapless Tazz a demonstration of her trademark ramming action; Blendo gets a pre-bout tune-up; a celebratory crowd packs the bleachers; Mark Setrakian lays out the workings of his mechanical snake; protected by quarter-inch bulletproof glass, spectators revel in the display of destruction; builders administer final touches in the bazaar-like "Pit"; Setrakian's snake wraps Scorpion in its clutches.



The contest is beyond bizarre: It's inhuman and demented. It's a theater of survival. The crowd roars with approval.



The Missing Link

Law professor **David Post** explains how cockroaches

hold the key to the borderless economy.

By Todd Lappin



Wired: Your career has taken you from physical anthropology to electronic privacy. What's the missing link between Jane Goodall and Mike Godwin?

Post: Thinking of communities as rule systems, like genetic systems or ecosystems, forces you to consider the ripple effects created by changes in the law. Biologists can't accurately say, "Raise the temperature a few degrees, cockroaches will get bigger, and there will be more mockingbirds" – other things mockingbirds feed on may disappear. Now take copyright law. Outlawing anti-circumvention technologies will change incentives for artists, who will react in unpredictable ways, which will affect other people, and so on. That's the nature of an interconnected system, in biology, law, and society at large. Related fields of study – evolutionary biology, microeconomics, game theory, tragedies of the commons – are beginning to fold together into a general study of how complex systems behave.

Sounds a bit like Edward O. Wilson. (See "From Ants to Einstein," Wired 6.04, page 178.) Are you preaching sociobiology?

No. Biology teaches us a lot – at the higher level of systems. But social behavior is not a function of the biology of individuals. You can't understand the behavior of the ant hill by understanding the biology of the individual ant.

But can we look to the natural world to solve policy problems?

Look at the broad applications of complexity theorist Stuart Kauffman's concept of "patching" – breaking up a system into self-optimizing units. A legal scholar quickly sees parallels to our concept of federalism: Everybody is always playing a complicated multiplayer game, with every different jurisdiction – cities within states, states in a union – searching for its own best configuration. The system works best when there is some, but not too much, spillover of harms from one group to the next. Pissing on your neighbor can actually help the system as a whole.

Pissing on your neighbor?

If information is not moving from one group to another, the patches don't get the systemwide benefits of experimentation. Everybody trying to solve spillover problems from other jurisdictions shifts the whole system, maybe to a higher peak on the fitness landscape.

What do you mean by fitness landscape?

Individual elements in any system can take different configurations, and the "fitness" of each can be measured against any criterion – say, aggregate happiness. Each change drives the system to some other place on the fitness curve: Some create rises, some create declines. Cut the legs off all the workers, and the system will probably end up in a decline. The hard part is finding the configurations that produce rises – social welfare, in the case of public policy, or better cockroaches in the case of evolution. Evolution is a search algorithm to find higher and higher positions on the fitness landscape.

How do we reach higher ground?

The one thing you don't want in an evolutionary system is to freeze solutions in place – say, the WIPO drive to create a uniform set of copyright rules. You want to preserve the pull and tug

of diversity, to have niches in the law for different cockroaches, so the system can continue to flourish as conditions change. A few years ago, people were talking about the copyright issues of caching; that has become moot, because caching has become a part of the landscape – like heat or sunlight – and people are adapting to it. What succeeds in an evolutionary sense is adaptability and flexibility.

The law, however, moves at such a crawl.

For 400 years, geography has been at the center of how we think of law as a tool of social control. Now that we've lost our moorings in the floating world of cyberspace, we need to apply complexity theory to these new legal problems and to reinvent primitive forms of a-geographical lawmaking.

The domain name grab, of course, looks a lot like homesteading. In the Middle Ages we had the "law merchant," a body of commercial practices that developed

from the ground up over time and spread from one commercial center to another. Going back even further, religions are very early examples of a-geographical rulemaking systems. Corporations have become similar institutions – they have their own internal rules, policies, and cultures that are not necessarily linked to any geographical region. The existence of these kinds of structures is not novel – what's novel is that they have become primary actors in this policy discussion.

What happens when you have someone very big at the top of the food chain?

Take Microsoft – is it denying the emergence of some creativity that would let the system evolve over time? That's exactly why the DOJ is moving. But with things like spam, where the harms are relatively minor, we should allow people to come up with their own, diverse solutions. Watching some roaches get eaten can give other roaches valuable information about how not to get eaten, and that makes for better and stronger cockroaches.

The law of the modern primitive?

Cyberspace is more like the state of nature than anything we've encountered in a long time. As an anthropology professor of mine once pointed out, if we lived in a world that contained only the color red, not only would we not understand "blue," but we wouldn't really understand "red." Cyberspace allows us to understand a new color, much as the settlement of the New World allowed theorists the opportunity to see what society would be like without a sovereign.

So it's a roach-eat-roach future?

Sometimes, to get from one high point to the next, you have to go down first. Our tendency is to simply get rid of the bad guys, just kill off all the mosquitoes. But then all the beautiful birds die. Complex systems find a way to adapt. We have to let cyberspace become more of a jungle – let it grow wild before we start pruning at the margins. You won't get order from law alone. ■ ■ ■

David Post is one wild man. As a grad student in physical anthropology during the 1970s, Post spent two years in Kenya observing the feeding behavior of yellow baboons. But not long after receiving a PhD from Yale, he turned his back on evolution and enrolled in law school, eventually clerking for Supreme Court Justice Ruth Bader Ginsburg. The law of the jungle, however, has proven too much to resist. In his recent incarnation as Temple University law professor and cofounder of the Cyberspace Law Institute (www.cli.org/), Post is applying his knowledge of complex systems to the untamed wilderness at the heart of information policy.

Todd Lappin (telstar@wired.com) edits *The Netizen*.

The Y2K Solution: Run for Your Life!!

**They were hand-picked
to kill the Millennium Bug.**

**They hunkered down and
started cranking out code.**

Now they're scared shitless ...

By Kevin Poulsen

Photography by Norman Mauskopf

Scott Olmsted is dressed to do some serious debugging: comfortable khaki shorts, a T-shirt from a Visual Basic conference, and a visor from one of his Silicon Valley employers. But we're a long way from the land of cubicles and industrial parks. In fact, we're a long way from just about everything.

Scott is debugging with a hammer, trying to remove a stubborn two-by-four from the wall of a mobile home plunked down in the high desert of Southern California. After banging away for a few minutes, he finally yanks the stud off the wall in a flurry of sawdust and splintered wood. It's a small victory, but it brings him one step closer to his own solution to the greatest computer glitch in history - the Year 2000 Bug. With more than 20 years of computer programming experience under his belt, Scott has decided that the only real fix for the Y2K problem may be to pack up and move to this patch of land 75 miles from his San Diego home. "In the next year or so," he predicts, "the most common cocktail party chatter will be, 'What are you doing to prepare for Y2K?' But by then, it will be too late."


This is sagebrush country, the kind of place where you can hear your footsteps crunching in the gravel. But even here, 30 miles from the nearest interstate, a line of telephone poles runs along the dirt road and PacBell terminal boxes sprout from the ground alongside the cacti. While carpet installers work in the next room, Scott is planning for the day when it may all be useless. The property came with a freshwater well, and he'll soon have a solar panel for power. For protection against looters, he's about to purchase his first gun. "I've seen how fragile so many software

systems are - how one bug can bring them down," he worries. The idea of hundreds, thousands, millions of bugs cascading all at once keeps him awake at night.

His Y2K retreat is easy to spot. In an area where high security means a few strands of barbed wire clinging to a rusty pole, Scott's chain-link fence is shiny and new. The alarm-company sign that hangs from the fence would be more at home in Brentwood, and on the roof there's a DirecTV satellite dish pointed toward the sky. The shed outside his back door will hold nonperishable food. But with a programmer's methodical logic, Scott didn't rush out to buy a year's worth of dehydrated grub. First he sampled the fare from several distributors. One company sold a textured vegetable protein that was a bit more expensive, but it came in a variety of flavors: chicken, beef, and taco. "It was pretty good," Scott says, in the halting measured tones of someone who doesn't want come across as a wacko. "We were pleasantly surprised." So he splurged. What the hell, doomsday comes along only once in a lifetime.

Throughout history, prophets and visionaries have spent their lives preparing for the end of the world. But this time veteran software programmers are blazing the millennial trail. The geeks have read the future, not in the Book of Revelation, but in a few million lines of computer code.

By now, the source of their anxiety is well known. In the 1950s and 1960s, when the computer world was young and memory was expensive, programmers developed a convention for marking the passage of time. It's the same system most people use to date their checks: two digits for the day,

A black and white photograph of a man, Scott Olmsted, standing outdoors. He is wearing a white t-shirt with a logo that says "V.P. Jump Start" and a hard hat. He is leaning on a large, dark, rectangular object, possibly a piece of equipment or a container. To his left is a large, cylindrical water tank. In the foreground, a German Shepherd dog is sitting and looking towards the camera. The background shows a house with a porch and some trees. The text "Veteran programmer Scott Olmsted is stockpiling food in the California desert. He's about to buy his first gun." is overlaid on the image.

Veteran programmer Scott Olmsted is stockpiling food in the California desert. He's about to buy his first gun.

two for the month, and two for the year. Dropping the "19" from the year was convenient, and it saved two bytes of precious RAM every time it was used.

Those were days of innocence and optimism. Everyone knew what would happen if this little shortcut was still in use in AD 2000 – the two-digit year would roll over like the odometer on an old Chevy, and the computers would think they'd jumped 100 years into the past. Programmers knew it, and they warned their managers. Not to worry, was the usual reply. When the millennium finally rolls around, all this code will be ancient history.

But the code stuck around. The old software worked fine in the postmainframe world, so nobody felt compelled to replace it. Instead, like Roman architects, they just built on top of it. The two-digit year became a standard, wired right into the heart of Cobol – the Common Business Oriented Language that still serves as the digital workhorse of commerce and industry. It also crept into the embedded microchips found in everything from VCRs to nuclear power plants. For years the Y2K bug sat quietly, remembered largely as an amusing textbook example of poor software design.

But as 2000 drew near, the screwup became less amusing. In November 1996, the comp.software.year-2000 newsgroup was launched, creating a forum that would soon become ground zero for the Y2K survivalist movement. But at first, the charter was clear: Discussions would be limited to Y2K bug fixes, remediation strategies, and reports.

Over the course of the next year, information poured into the newsgroup, and most of it was bad: The FAA was hopelessly behind schedule in patching air-traffic-control systems; Edward Yardeni, chief economist for Deutsche Morgan Grenfell Bank, laid odds that Y2K upheaval would trigger a recession; Ed Yourdon, a respected software guru and author of 25 computer books, predicted the collapse of the US government – not long after he packed up and moved to New Mexico.

Optimism became a scarce commodity. Philosophical questions were raised: Do programmers have a moral duty to remain at their keyboards until the last moments of 1999, like captains on a sinking ship? Debates raged over social Darwinism and the ownership of wheat in grain elevators. The conversation moved on to the viability of dry dog food as emergency rations. Plans were made to begin converting equities into gold and buying land in remote parts of California, Arizona, and Oklahoma. January 1998 saw 250 cross-posts to misc.survivalism – up from an average of 30 a month in late 1997. Gradually, a new acronym entered the Internet lexicon: TEOTWAWKI, pronounced "tee-OH-tawa-kee." The End of the World as We Know It. The Internet's very own survival movement was born.

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Kevin Poulsen is a columnist for ZDTV.com.

Scott Olmsted has known about the Y2K bug since the 1980s, but he never gave it much thought until early 1997, when he received a snail-mail flyer from Gary North, a historian and early leader in the Y2K preparedness movement. After reading it, Scott remembers feeling a vague sense of dread. But as a rational guy and student of decision analysis – the science of logical decision making in the face of chronic uncertainty – he didn't jump to any conclusions. Instead, he went online to do some research. As he pored over Web sites and news clippings, Scott felt himself moving through the same psychological stages endured by people confronted with fatal illness: denial, fading into anger, leading to a deep depression that culminates in a sense of acceptance. "I'm still not 100 percent sure that the world's coming to an end," he admits. "But the idea that I may want to get out of town for a while is not such a long shot. It's enough to make me want to prepare."

With the exception of his wife, most of the non-geeks closest to Scott think he's a little nuts. His half-brother, Clark Freeman, thought he was going overboard. But since then, Clark has come around a bit – he, too, is planning to stockpile some food in case things get rough. If his brother is taking Y2K so seriously, he figures there might well be something to it. "Scott has always been the level-headed one," Clark remembers. "The classic straightlaced nerd."

"I've spoken with friends and relatives about this, and I've gotten nowhere," Scott sighs. Worse, some of the more intense Y2K survivalists also think he's crazy – or at least a bit naïve. After all, Scott plans to celebrate New Year's Eve at his home in the suburbs; the place in the desert will be there just in case things get rough. Then there's his fence – it has no perimeter alarms, and he isn't even trying to camouflage his location. But worst of all, his hideaway is only a half tank of gas away from Los Angeles – close enough to the big city that he could wake up one postapocalyptic morning to find hordes of Los Angelinos parked outside his desert redoubt.

The hardcores believe it will happen like this: On January 1 (or shortly thereafter), the electricity grid will go dead. Groceries in America's refrigerators will go bad. Food distribution systems will crash and store shelves will go bare within days. Businesses will fail, either because they aren't Y2K compliant or because they are dependent on noncompliant customers and suppliers. As losses mount and companies go under, the stock market will plummet. Banks will calculate interest for negative 100 years. The government will stop issuing entitlement checks to gray-haired senior citizens when their age suddenly clicks back to -35. Panic will set in. Police dispatch systems will be crippled, and the only law will be the law of the jungle. Desperate citizens will abandon the cities to hunt for resources in rural areas. They'll come looking for the mad prophets – the Y2K

A new acronym has entered the Internet lexicon: TEOTWAWKI. "The End of the World as We Know It."



Gimme shelter: On 500 acres in Oklahoma, systems analyst Steve Watson is building a camouflaged bunker big enough to house 40 people. In the meantime, he's learning all about leather tanning, alternative power, and emergency medical procedures.

survivalists – ready to plunder their food, their heat, and their communications links. They'll zero in on Scott and his conspicuous retreat like a pack of wolves on the scent of a kill.

But they'd better stay away from Steve Watson's place.

Steve Watson, a 45-year-old systems analyst, is still kicking himself for not preparing sooner. He didn't get going until early this year, and he worries that he still has a lot of adjusting to do. As he puts it, "I didn't even know how to tan a hide until a couple of months ago."

If all goes according to plan, Steve will ring in the new year at a secure compound somewhere in southern Oklahoma. While the Pollyannas of the world watch Times Square on the tube, he'll be listening to the radio for early news of Y2K disaster. When the power goes black - perhaps at the stroke of midnight - he'll be ready with a small arsenal of guns. A generator will power his bunker indefinitely, but no light will escape to the outside - none of Steve's neighbors will even know that there is a survivalist in their midst.

Eight months ago, if you'd told Steve that Y2K survivalism would become his obsession, he would have laughed in your face. Last 164 ►



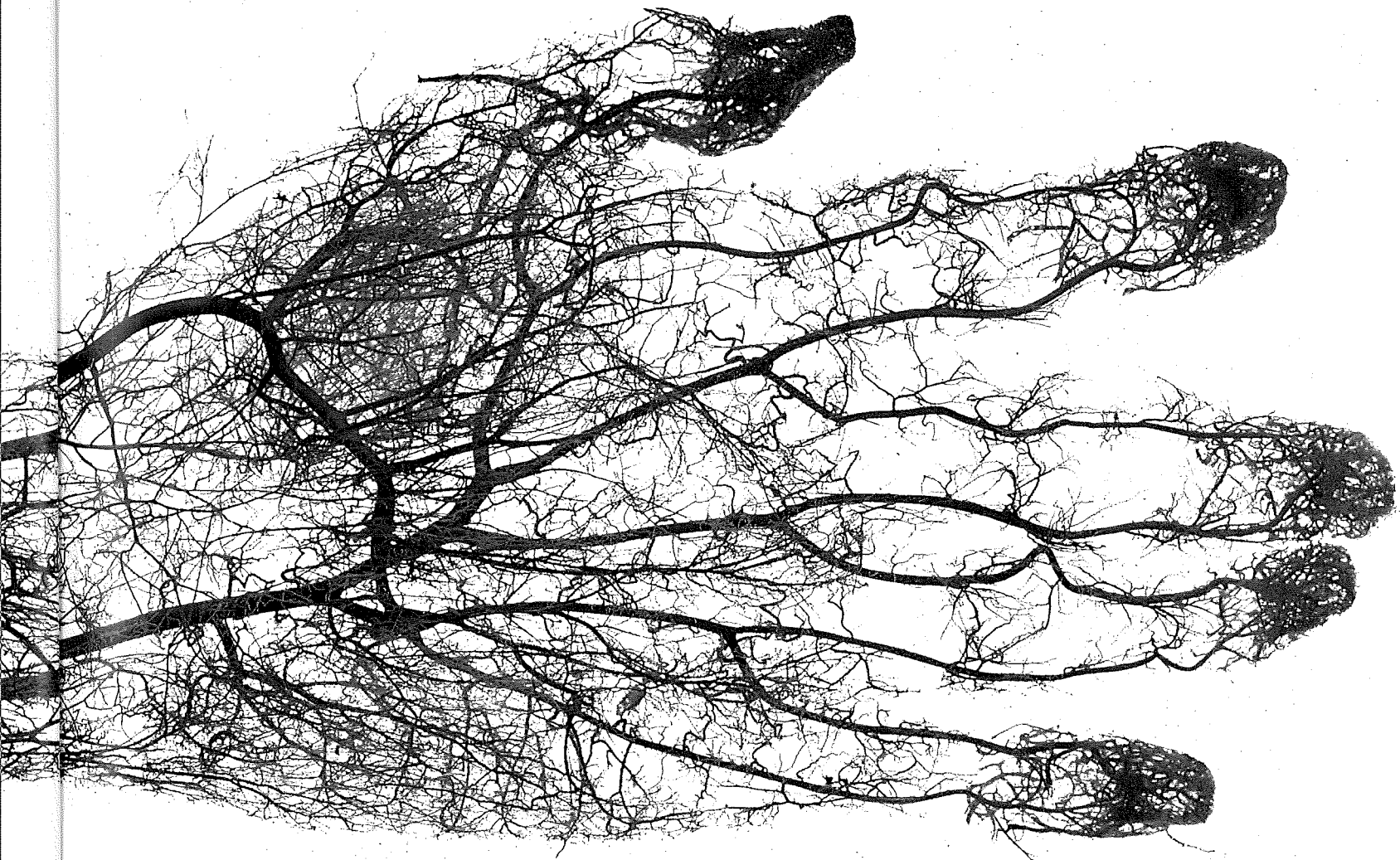
(In)visible Hand

Gunther von Hagens gets under your skin – permanently. To make his job easier, the German anatomy professor developed plastination, a method of preserving the post-mortem body down to

its smallest visible detail. For this specimen, the arterial blood vessels in a forearm were drained and then injected with a colored polymer; the compound was then hardened and all surrounding tissue was stripped away.

Von Hagens's work is on full display in *Körperwelten* (Body worlds), an exhibition that graphically reveals the human form in various stages of anatomical undress. Having toured Japan and Ger-

many, the show has no fixed future plans; the catalog, in German and Japanese, is available from the Heidelberg-based Institut für Plastination – fax +49 (6221) 332859 for more information.
– Katja Grubitzsch



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The Net made it possible. Java made it doable.

Jini might just make it happen. An on-the-fly, plug-and-work,

global nervous system that connects his cam

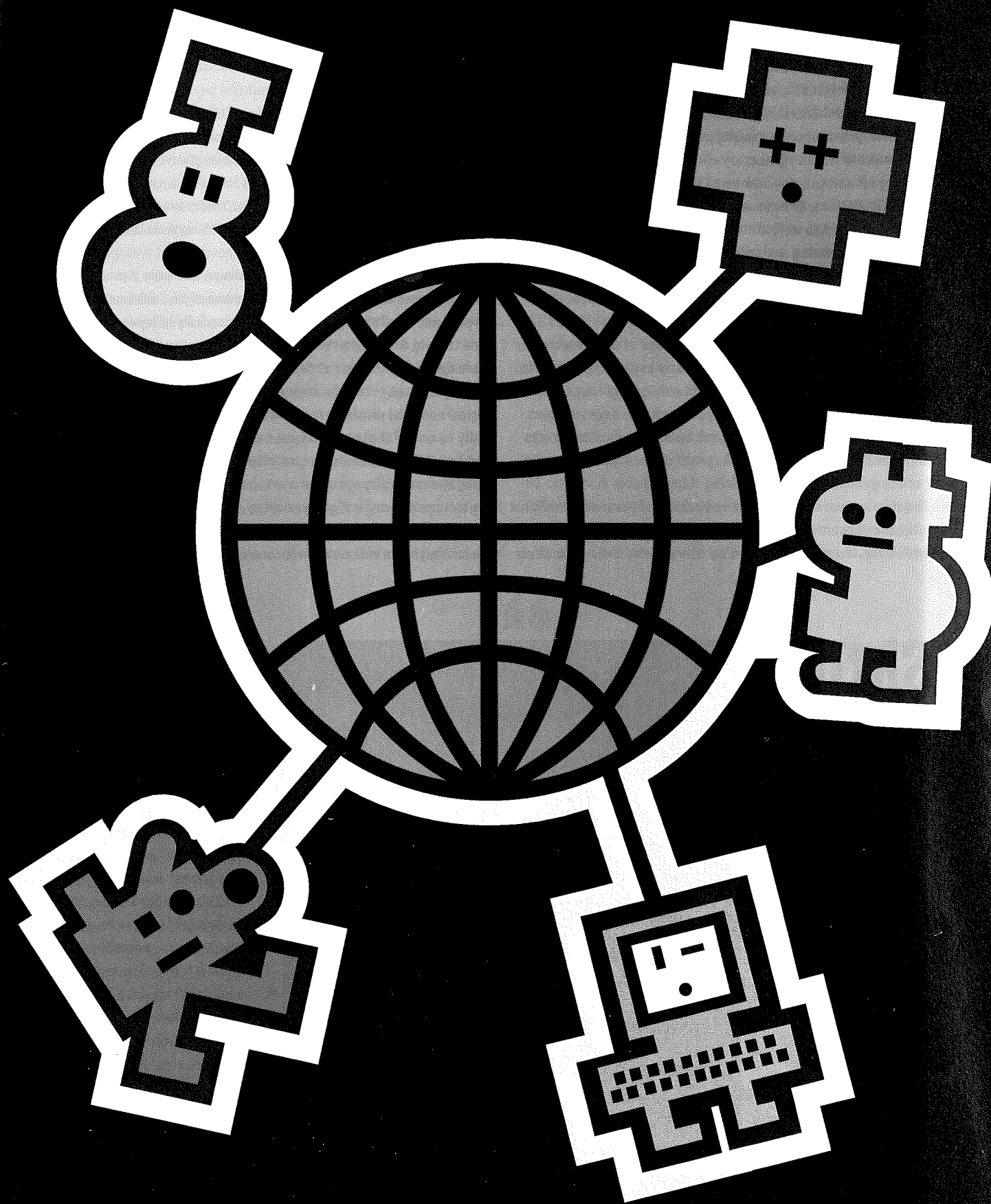
to her RAM to your PDA. By Kevin Kelly and Spencer Reiss

One Huge Computer

The Irresistible Dream: Ever since Marshall McLuhan, a central dream of the digital culture has been to create one huge computer. Not a towering super-brain tended by white-coated priests, but a vast constellation of interacting machines — processors, memory modules, disk drives, and a million other devices, all networked into a vast planetary system. A means of thinking, creating, and communicating that is everywhere at once, but nowhere in particular. A computer that is always on. Such a system would continuously spread itself and thicken, expanding by its own internal logic. It would be supremely adaptable, and hard to break. It would have myriad access points, but no CPU, no single point of failure. The global village, to coin a phrase, made real.

Engineers have long had a word for systems whose powers are widely dispersed: distributed. Banking, telephones, the electric power grid — the bigger something is, the more likely that it will be distributed. The Internet is arguably the biggest distributed system ever built, and the most complex. ►

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Executive editor Kevin Kelly (kevin@wired.com) is the author of New Rules for the New Economy (Viking/Penguin, 1998); Spencer Reiss (spencer@wired.com) is a senior editor at Wired.



But all these are specialized, essentially one-dimensional undertakings – processing money, electricity, or communications bits. They pale against the ambitions of a system that aspires to be everything – to everyone.

For the biggest of thinkers, that sets up an irresistible dream: to build the network that makes all networks one, a global nervous system. The napkin sketch is simple: Take all the intelligent machines in the world – from giant mainframes to the tiniest embedded chip – and hook them together in a single intelligent network. A system open to novelty, new members, and features. A system that can tolerate what engineers ruefully call faults. A system with no limits on how large it can get, nor how small its smallest part can be.

Add a few more stipulations. To have any chance of working, the global network's structure will need to unfold from simple principles, rather than from ever more complex planning and central control. And, like another well-known distributed-computing device – the human brain – it will need to be able endlessly to reconfigure itself, to solve unanticipated problems and address unforeseeable new needs.

The key pieces for such a system – millions and billions of microprocessors – are already here, or coming. So, too, are the riotously expanding networks. Indeed, to start building that one great computer, only a single essential ingredient is missing: an architecture, a universal language, a set of super-protocols, something – and very possibly today's lexicon can't name it – to hold it all together and let the magic work. A constitution, if you like, a digital equivalent of the genetic code that all living things share.

Or, just maybe, this: a crash effort cooked up by some of the most ambitious minds ever to flee the corporate confines of Silicon Valley – a secret project spearheaded by Bill Joy, the software luminary who put the Internet on Unix

and Java on close to 100 million desktops and whose fondest wish now is to give the world, to use a favorite Joy phrase, one more good “technological dislocation.” He's sure he's found one. And appropriately, it's called Jini, loosely from the Arabic for magician.

General magic

In a windowless second-floor room in a deliberately obscure Sun Microsystems outpost in Sunnyvale, California, half a dozen anonymous chunks of expensive-looking hardware sit on long folding tables. Some barely rate a first look: a not particularly recent printer, what look like a pair of flat-screen monitors, a video camera, a couple of keyboards. Others are clearly prototypes: over-designed purple computer-somethings with curved sides and stylized vents. Any Demo, Silicon Valley, USA.

Turn any of the devices around, however, and only two wires are visible: electric power and an RJ-45 Ethernet connection. Each box – even the display screens and the little handheld camera – is a fully independent network citizen, able to hold its own on the system, unencumbered by specialized cables, software drivers, or the rest of the usual array of digital life support.

Say you want to use the camera. Plug it in, and poof – a second later, an icon appears on your display screen. All the configuration chores are done automatically by one of those purple boxes – a low-end server called a lookup device – and by a 25K communication program in the camera. What's in the viewfinder? Bring the camera image up on a monitor – any one you like. Store a clip? The 10-gig storage device – a slightly smartened-up disk drive – is waiting. Edit? There's another of those purple boxes, the computing device, with full workstation power. Pull some video-edit software out of the storage module, and you're off.

Joy Shtick

Bill Joy went to Aspen to think small. His latest little idea: dynamite the computer industry as we know it.



Wired: What do you see as your job?

Joy: I like to create technology dislocations. How much dislocation they ultimately create depends on how well they are executed by the organization that I have some involvement with. Typically, once I make a dislocation I am on to trying to find the next one.

What are some technological dislocations happening these days?

In microprocessor design you can make a chip for a dollar. We are in “the second half of the chess board,” where Moore's Law of doubling has reached a point that every doubling now makes a huge difference. A single chip becomes a system. Now we can build a whole economy around the way chips become systems.

What about bandwidth?

It's coming. In Aspen, where I live, we have a spread-spectrum 1-megabit T1 wireless network which we put in ourselves. This network covers the

IMAGE: KAREN MOSKOWITZ

That's one possibility. Or maybe you'd rather batch print some letters from your laptop. Done. Or get that old laser printer online. A pocket-sized adapter does it. Or add another 10 gigs of storage – no need to call a sysadmin, just grab a drive off the shelf, and plug it in.

On one level, the demo is the ultimate in plug-and-play technology – “plug-and-work,” its Sun-shirted minders note with a smile. No mean feat. Not surprisingly, some of the Jini demo's most interested visitors have been from hardware companies that would dearly love to find a way for us all to snap a few billion more microprocessors, disk drives, and other smart devices into our personal networks.

But Jini aims much higher. What Joy and the two dozen programmers working with him aspire to do is nothing less than dynamite the whole creaky logjam of computing, as it has evolved from giant mainframes through the first clunky PCs to today's cobbled-together Internet and Windows Everywhere. If they succeed, Jini code will provide connections that will make today's information “superhighways” look as confining as 19th-century railways. And that, Jini thinking goes, will be the foundation for truly networked, global computing – organic and ever changing, and keyed to a hurtling future instead of being shackled to the platforms and conventions of the past. “When the foundations are so far off,” reads an internal Sun document written to support the project last year, “it makes sense to do a reset.”

Coming from almost anywhere else, that declaration would be laughable. But Sun and Bill Joy have come close once already to pushing computing's reset button, with its still-expanding programming language Java, the most important development in computing since the explosion of the Internet. What Java aims to do for software – be a lingua franca – Jini hopes to do for

the machines that run it: provide an overarching, universal platform – a distributed operating system, in effect, on which devices of every description can meet. “Jini is the next chapter in the Java story,” reads another project mantra.

And Jini is no clunky hack, strung together in a lab with glue and wire to impress the boss and calm investors. Most of the demo devices are modified versions of existing hardware – one of the project's driving ideas is to not have to throw existing systems away. Jini software has been in limited-release beta since June, with testing under way by some of the biggest names in computers and consumer electronics – NEC, Toshiba, Quantum, Ericsson, Siemens, Computer Associates, and a dozen others. By the end of the year, Sun hopes to release a full package, from a network infrastructure to the little 25K program that can put your front-door light switch onto the network. The release name is still being debated, but the marketing plan is not: It will reprise the same strategy that fueled the explosive take-offs of both the World Wide Web and Java – essentially, give it away. “There's one thing we've all learned from watching Java and the Net,” says Mike Clary, Joy's key colleague in Aspen and Jini's overall project manager. “This can only be a ubiquity play.”

Jini's prelaunch team shares a building with what remains of another audacious attempt at networking heroics, General Magic – a reminder of the casualty rate of would-be technological revolutionaries. A Jini victory would mean the creation of a loosely connected federation of computers freed from today's OS tyrannies – one reason not to expect a friendly Microsoft embrace. Neither Bill – Gates or Joy – needs reminding that it was the modest little PC's universal appeal, not the US Justice Department, that ultimately humbled IBM's mighty mainframes. And if lightning strikes again, those anonymous boxes

whole town. It operates as our LAN, except we put antennas up on the mountains so we, and others, can go anywhere in town and be on it. It was just an experiment. There is a cab driver in town who has a wireless T1 in his taxi and a laser light show and all this gear and MIDI on board. He is truly wireless. But by doing this time warp, we discovered a discontinuity. There is a break point in bandwidth around a million bits, or a megabit, per second. If you get below a million bits you notice the lack of speed. But with anything above 1.5 million bits you hardly notice the increase; the difference between 2 megabits and 10 megabits is negligible. It is really surprising. One of the current myths of the digital era is that we have an insatiable appetite for speed and storage, yet probably neither is true. You seem to be suggesting we now know the saturation point in bandwidth speed.

Yes. Before I got involved with Java, Mike Clary and I were looking at threshold points. A number of people have calculated that if you were to record everything you ever said and everything you ever typed, the storage needed would not be that high. And cheap, even at today's prices. I recently saw a plug-and-play 14-gigabit server for US\$1,200. I mean, 14 gigabits is more than you will type in your life. It may be more than you will say.

Where are we in the curve toward the Network Society?

We know Moore's Law will run out sometime around 2010. It's probably not going to be a crash into the wall. Things will just start slowing down. We've been getting a free ride with Moore's Law. We can write worse and worse software, and the machines just get faster and faster

“I like to create technology dislocations. How much dislocation they ultimately create depends on how well they are executed by the organization that I have some involvement with. Typically, once I make a dislocation I am on to trying to find the next one.”

and cheaper and cheaper – and they cover our tracks.

Do you think there is a dislocation as a result of wireless and mobility itself?

Whether you have to sit in one place to do your work or you can move around is a big deal. Your life changes.

What comes after cheap chips and mobile bandwidth?

The next step after cheap is free, and after free is disposable.

User interfaces – is there a dislocation there?

Microsoft would say it's going to be speech input. I kind of doubt it. You're talking to me, but you don't want to have to be talking to your notebook at the same time. So you write. The future is probably much more gestural.

You've been writing computer languages like Java. Do you envision a computer-language dislocation? 171 ▶

in the windowless demo room could someday end up in a technology museum: cell zero of the global computer. Not to mention giant slayers.

If ...

Up from Java

Bill Joy doesn't like the word "exile," but he's made a second career out of keeping most of the Rocky Mountains between himself and Silicon Valley. A founder of Sun Microsystems and still officially Sun's VP for research, Joy took himself to Aspen a decade ago to build a geek-lord's dream: his own custom research-and-development lab, aka Sun Aspen Smallworks. Small? "Ideas resemble the organism that built them," Joy says, "so a small organization will build simple things that work." Meaning what? "The idea is that we do whatever is most important – not necessarily most urgent. Sun has 20,000 other people doing that. I left the urgent behind to get to the important."

In the early days, Joy and a rotating Smallworks crew focused on what they dubbed the "4MY" program – "Four Miracles a Year," everything from micro-chip design to networking theory. More recently, Aspen was a refuge for the long-running project that became Java, from its early near-death experiences as "Green" and "Oak" to the first big licensing deals.

It's a pleasant place, Smallworks, behind one of those too-cute Victorians above the year-round commotion of shops and restaurants in downtown Aspen. Joy and a couple of permanent staffers inhabit a cheerful clutter of exotic gear, whiteboard, and piles of books. But blissed-out the view definitely ain't – the view of the high tech landscape, anyway. "We're in the Dark Ages," Joy says, wheeling out his favorite rant. "It's 900 AD – medieval computing. Except for the Web, what's really getting better? I managed to get my note-

book computer to talk to the printer – it took a month. Our basic operating systems now have some 20 million lines of code, and more is being piled on every day. It's insane to try to build the future on that."

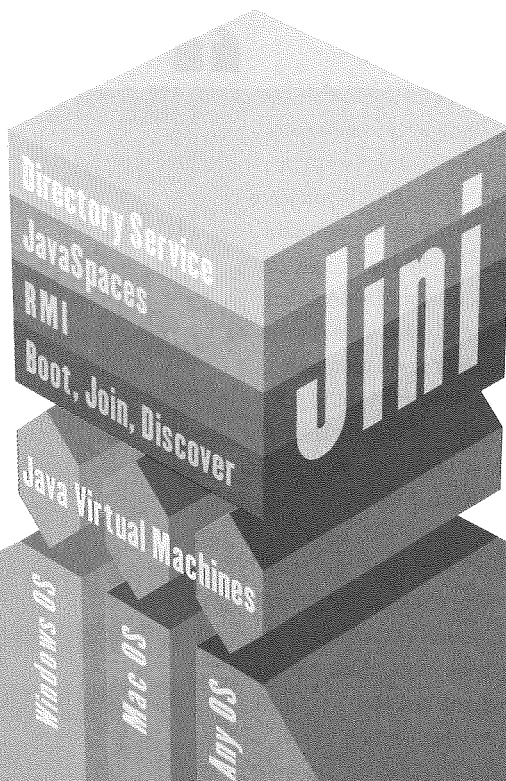
Indeed, from whichever angle you look – Silicon Valley prince or baffled user – complexity and scale are the mad aunts in the attic of today's computing. Lines of code piling up like crust on hard drives are only part of the problem – the real nightmare starts when you add blossoming networks to the mix. Systems engineers measure complexity with a metric: number of users times number of machines times number of functions being undertaken. Put a couple of those numbers into the millions or billions – which the Net explosion is doing – and you get unmanageably huge, quickly. Unless, of course, you have a system that can pull order from networking chaos.

Visionaries and hard-headed engineers – not to mention Windows-for-all Gates – have been groping for years to find paths through the spreading complexity. Ted Nelson's Xanadu, Xerox PARC's Smalltalk, David Gelernter's Linda; the list is long and not encouraging. One general path has been idealized – start-from-scratch systems, most of them quixotic or mainly research ventures. Another, less sweeping approach has been object-oriented programming – building applications on the fly from small code modules, usually called objects, the better to move them around a network or translate across platforms. Two rival object standards, the industrywide Corba and Microsoft's DCOM, have kept sprawling corporate networks from degenerating into towers of Babel. And then, of course, there's the one unalloyed success story of distributed computing: the Internet, and its prodigal, the Web. Ironically, though, TCP/IP's very success in creating a global medium has only made the overall problem of complexity even worse.

Jini is a set of new software layers that together create an overarching "federation" of computer devices and services.

On top is a **directory service**, based on a "lookup" mechanism that allows different Jini-enabled devices and applications to register

and be seen on the network. The next-level service is persistence, provided by **JavaSpaces** technology, which stores objects so that other users or applications can retrieve them (see detail). Below that, a set of protocols based on



Java's **Remote Method Invocation** enables objects to communicate and pass each other code. And finally a **boot, join, and discover protocol** allows Jini-compatible devices, users, and applications to announce them-

selves to the network and register in a directory.

Any device with an operating system capable of supporting a **Java Virtual Machine** – meaning, in practical terms, any modern computer – can be linked with a Jini network. Simpler devices can also join, though on a more limited basis.

As the Net's explosion gained force three years ago, Bill Joy was deep into Sun's own object-oriented programming effort. The motives for releasing Java – an elegantly stripped-down language originally designed to run consumer electronics – were less than pure and more than a little desperate: to blunt "Windows Everywhere!" with a new technology that promised platform independence. The ability to run the same program on any computer – Mac, Windows, Unix, a tiny device on your wrist – is a key distributed-computing tenet, not to mention an obvious boon to a global information network. Skeptics laughed nonetheless. But the timing was perfect – even more so when Netscape, looking for allies and ammunition against Microsoft's gathering counterattack, built Java compatibility into its runaway-hit browser. What might have been another high-minded experiment instead became an instant global standard.

Sun from the start has famously been the company that preached "the network is the computer." But even for Joy, holed up in Aspen writing the Java specs, that explosion was astonishing. Though Java was launched as a new programming language, Joy and the others had always assumed that they would slowly build it into a full software platform – one that really fulfilled the brash early promise of "write once, run anywhere." Their best guess had been that it would take five years to achieve what they reckoned was the critical mass needed to launch a viable distributed platform – about 100 million users. But the Net's amazing growth had them scrambling almost immediately. The good news was that Joy and the rest of Sun's software research team already had a clear sense of where they wanted to go. "We knew that whatever we did had to be technically simple," says Joy, "because it's hard to write programs, and even harder to write distributed programs –

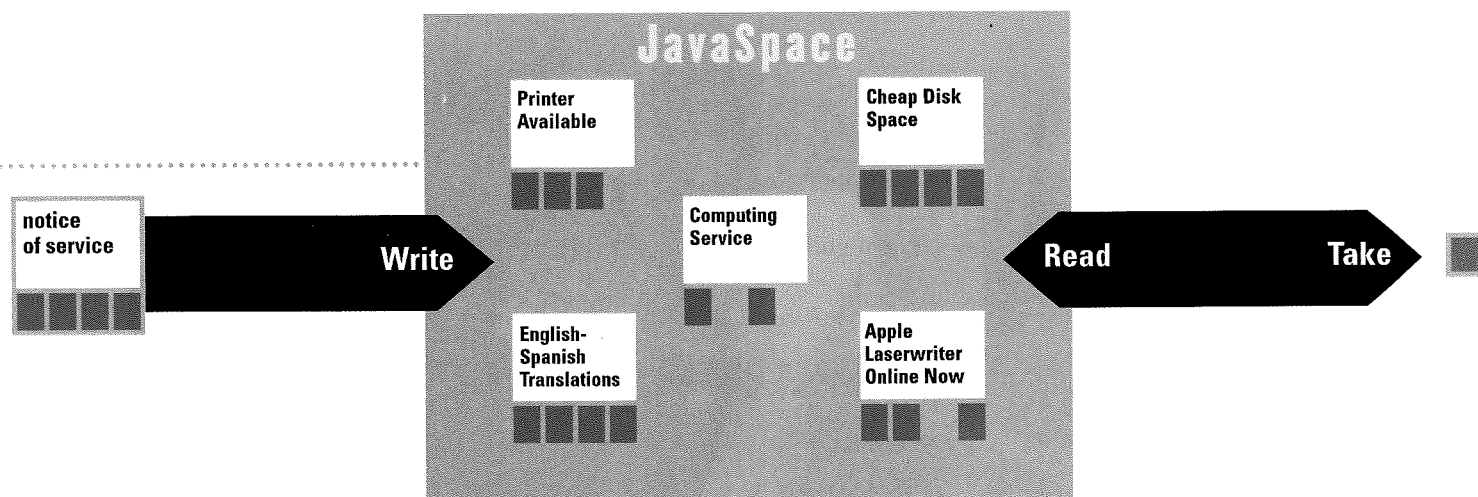
you have the whole big complicated system to think about. What we wanted was a very simple communications mechanism that would let the distributed system work."

One of Joy's favorite engineering maxims – "Large successful systems start as small successful systems" – is another way of saying: Use what already works. In 1994, the Aspen skunkworks already had a workstation running Oberon, an ambitious attempt by Zürich-based Niklaus Wirth, the inventor of Pascal, to create a featherweight system written entirely in one simple programming language. Such knowledge-based computing erases the conventional distinction between the OS and applications. Building distributed networks, Joy believed, was a key breakthrough. Another intriguing model was Gelernter's Linda, whose central idea, called "tuple spaces," is a radically simple way to organize communication between software objects; Linda's broad concepts had already been adopted for JavaSpaces, a tool for building distributed applications.

And then there was Java itself, which continued to build momentum among programmers – and with that, more and more of the plug-and-play software components crucial to making object-based programming work.

In the spring of last year, Joy sat down in Aspen with Sun senior staff engineer Jim Waldo, whose research group had just completed Java RMI – Remote Method Invocation, an interface tool that lets distributed software objects find and communicate with each other over a network. Sketching on – yes – a napkin, they realized that the practical outlines for a full-out distributed-computing system were already visible. They also had the people, based mainly in Sun's East Coast software research lab in Chelmsford, Massachusetts. Waldo himself had already started the basic code for what

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JavaSpaces are virtual "bulletin boards" or "market-places" – the heart of Jini's distributed networking. Using a few simple programming methods, including "read," "write," and "take," JavaSpaces make software

objects available to anyone in a network. The objects themselves can define a job to be done, a problem to be solved, or a service being offered. A JavaSpace can be as small as 10K and as large as 100 Mbytes.



WHAT'S THE DIFFERENCE BETWEEN A LITTLE KID WITH A WEB SITE AND A MAJOR CORPORATION WITH ONE? NOTHING. THAT'S THE PROBLEM.

Building a publishing-only Web site is the first step to becoming an e-business. A step that most businesses (and a lot of little kids) have already taken. That's fine as far as it goes – it's a very cost-efficient way to distribute basic information.

But the real payoff (for businesses, at least) comes with steps two and three. Step two is moving to "self-service" Web sites – where customers can do things like check the status of an account or trace a package online.

Step three is moving to transaction-based Web sites – not just buying and selling, but all processes that require a dynamic and interactive flow of information.

IBM has already helped thousands of companies use the Web to make the leap from being a business with a Web site to being an e-business – putting their core processes online to improve service, cut costs or to actually sell things.

For example, we helped Charles Schwab Web-enable their brokerage systems for online trading and customer service. Since opening, Schwab's Web service has generated over one million online accounts totaling over \$68 billion in assets.

e-business economics are compelling. According to a recent Booz-Allen & Hamilton study, a traditional bank transaction costs \$1.07; the same transaction over the Web costs about 1¢. A traditional airline ticket costs \$8 to process; an e-ticket costs just \$1. Customers love the convenience; management loves the lower costs.

IBM solutions have already helped thousands of businesses become e-businesses. To find out how IBM can help you do the same, bookmark www.ibm.com/e-business or call us today at 1 800 IBM 7080, extension NC32.



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Speech Recognition – To Go

Dutch Hitmeister

For much of its history, electronic music has been a boys' club. So why should you give a damn about a 12-track debut from an obscure Dutch songstress? Because Elisabeth Esselink, aka Solex, crafts confections of exquisite whimsy and because *Solex vs. the Hitmeister* is the perfect antidote for your summer ills.

Spin yourself into a ditty like "Waking Up with Solex," which grooves with a bluesy loop, decorated with sparks of electric snickers and whoops. The song melts into "Solex"



Electronica of import.

Snag, "a dark, funky romp that nods to the Amsterdam's contemporaries The Ex and Dog Faced Hermans.

Esselink's voice is childlike but not childish, and her music is strikingly mature; *Hitmeister* brings a new aesthetic and humor to a medium in need of both. If Björk and Stereolab are stealing electronica's baton from the boys, Solex is off and running with it. Catch her if you can. — Colin Berry

Solex vs. the Hitmeister, by Solex: US\$15.98. Matador Records: +1 (212) 995 5882.

Following in the footsteps of IBM's ViaVoice and Dragon Systems's NaturallySpeaking, Speech Machines's CyberTranscriber promises professionals another way to conduct business on the fly. The Internet-based voice-recognition service lets you dictate a message by phone or computer and have your dictation emailed to you the next day.

If you're a slow typist, a fast talker, on the road with only a dinky palmtop keyboard, or just caught up in the afternoon commute with your cell phone, this could be the ideal mobile solution. After registering at the Speech Machines Web site, you simply dial a toll-free number, punch in your account number and PIN, and start talking.

Your voice message is then encrypted, compressed, and sent over the Net to the company's service center in England. Once there, some heavy-duty proprietary speech-recognition engines pioneered by the British military go to work turning your voice into text, after which proofreaders on the remote Scottish island of Bute check it for accuracy.



Your dictation does a bit of globetrotting before returning as email.

All this global handshaking can take as little as three hours.

And, for the most part, it works. For my toll-free test run, I dictated the most riveting technical press release I could find. Sure enough, it arrived via email the following day. It wasn't perfect, however. There were question marks and a word missing in the very first sentence (I admit, I was testing the company's speak-as-fast-as-you-like claims, so I might have butchered the Queen's English a little). The word "definitely" came back out of context as "defiantly," so that Scottish proofreader was either having some fun or had nodded off at the wheel.

The service also works with your home PC. If you use the Voice It Worldwide digital dictation machine, which ports into your computer, you can transfer voice files.

Whatever your flavor, speech recognition has come a long way, and CyberTranscriber's service takes it further still. — Jackie Bennion

CyberTranscriber: US\$29.95, plus monthly fees. Speech Machines: +1 (650) 568 1500, on the Web at www.speechmachines.com/.



Tune in to Internet Radio

Cine-Exposure

For the past three years, Seattle cinephiles have been blessed with a monthly microcinema presentation from Blackchair Productions called *Independent Exposure*, in which the city's Speakeasy Cafe becomes a screening room for new short films, videos, and computer art. Now the rest of us can find these jewels on the Internet.

The Sync Web site presents these monthly minifestivals in RealVideo. And what a selection of films! There is the seven-minute romp *Wire Girl*, billed with the breathless lines: "She's young, she's beautiful,



Indie paradise.

she's totally naked, by Mark O'Connell." Somewhat more sober, but equally eye-popping, is *Hooray! The Economy Is Booming*, in which the current cheery national fiscal news is somehow lost on those who pay bills. *Enter the Shag* portrays a battle royale between Dog Star Man and Fist of Fury.

Independent Exposure offers a loopy collection that is never mundane. Forget the multiplex, the video store, or the TV — get on the Internet and catch these films! — Phil Hall

Independent Exposure: free. The Sync: +1 (301) 806 7812, on the Web at thesync.com/.

How many audio applications do you have on your hard drive? Xing, RealAudio, Liquid Audio, and the abysmal NetShow? Get ready for a slew of new products that look nicer and have more interactive features. Imagine Radio and Spinner.com (formerly TheDJ.com) both have stand-alone (non-Web-based) players with the promise of customized desktop radio. No more suffering through lame tunes or waiting all day to hear that elusive new Cornershop single. Hear a song, one click gets you the album.

Imagine Radio and Spinner.com bring you high-quality audio as you work, provided you have a very fast computer and a speedy Internet connection. In other words, don't try this at home, where these services will drop packets like crazy, resulting in choppy listening.

Both apps feature banner and audio ads; Imagine Radio plays four minutes' worth per hour, while Spinner.com has less than two. But as listeners to the ad-packed Howard Stern show know, there is more to radio than just avoiding commercials. Imagine Radio has hired radio professionals to "program" its nearly 20 stations, and it carries



Pump up your connection, then pump up the volume.

24-hour news from the Associated Press, as well as a stable of talk shows. Spinner.com has plenty of songs (try 100,000), but no news or talk shows. It does allow independent musicians to have their music added to the rotation — a good and bad thing. Both apps allow you to rate songs, which affects their play frequency.

While Imagine Radio has players for both Win95 and Macintosh users, Spinner.com supports only Win95 and NT. At 6 Mbytes, Imagine Radio's download is large, but it includes the necessary RealAudio components. Spinner.com's app is less than a third that size and also includes RealAudio.

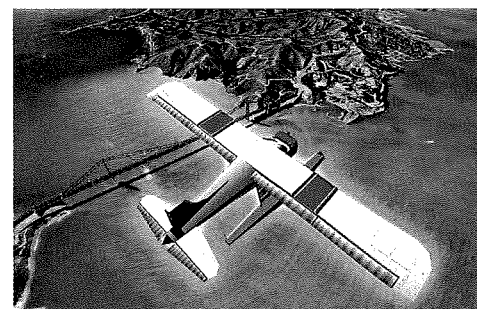
Clearly, Imagine Media and Spinner.com are trying to move the 70-plus-year history of passive radio listening into a more user-defined, computer-based world. That's no small task, but both these imperfect apps are significant steps beyond the current lineup on your local dial. One can only hope this spells the demise of plastic transistors spewing out mindless Top 40 modern rock. — Richard Dean

Imagine Radio: free. Imagine Media: +1 (415) 468 4684, on the Web at www.imagineradio.com/. Spinner.com: free. Spinner.com: +1 (650) 762 1700, on the Web at www.spinner.com/.

When the Background Eclipses the Game

If I were asked to write about this product as a flight simulator, I wouldn't touch it with a 110-key keyboard. Yeah, the geeks who created this program *thought* they were writing a flight simulator, but forget the airplanes and get ready for something real.

Using the wizardry of high-res satellite imaging, it is the *background* of *Flight Unlimited II* that is the real story. It's a combined road map, real estate searcher, and detailed view of the San Francisco Bay area (with other areas to come). Hit Control-Z and leave the plane behind. You can move yourself at Warp 9 to fly over the Golden Gate Bridge or to find out what's behind the Stanford Linear Accelerator. This is no flat map; this is a genuine 3-D model. The way it looks is the way the land is.



Bird's-eye view: a flight-sim with amazing satellite image maps.

I introduced my off-the-beaten-track-house-hunting friend Lyn to my with-it real estate broker Jerry. We investigated the hilltops south of San Francisco, where you can see both the ocean and the bay, and little-known valleys near Livermore. Want to see how the view looks from a potential home site? Fly there and look around.

This might be the best way to tour the topography of the Bay area ever invented. I learned about places I didn't know existed. OK, I did fly the Mustang *through* the hangars at Moffet Field, but then I'm an airplane nut.

It's not perfect; some places have more detail than others. Berkeley is a bit fuzzy. But what did you expect? If you get bored, use it as a flight sim. You can't lose. — Jef Raskin

Flight Unlimited II for PC: US\$49.99. Looking Glass Studios: +1 (617) 441 6333, on the Web at www.lglass.com/.



Monkey Business

I don't think I'm the only art collector who secretly wishes that her budget for purchasing hard drives, memory upgrades, and software could be siphoned into purchasing paintings instead. Luckily, there's a quick fix: the limited-edition screensaver by artist Sue Coe. This "ambient art installation for the computer" is both a video screensaver and a stand-alone application that turns your monitor's utilitarian frame into a thought-provoking showcase.

Titled *Monkey Business*, Coe's screensaver represents her first work created expressly for the computer (her large-scale paintings and illustrations appear not only in galleries around the world, but in the pages of *The New Yorker* and *Time* as well). *Monkey Business* features a collage of arresting images, a visual commentary that questions the motives behind humankind's supposedly advanced culture. Coe offers colorful frames depicting serene jungle primates existing



Artist Sue Coe's screensaver takes a critical look at all primates. peacefully within an idyllic nature juxtaposed with dark, gray scenes of violent human primates attempting in vain to control and manipulate nature into "civilization." All images are taken from a series of original paintings that Coe created exclusively for this project; some scenes are animated – a baby chimpanzee blinks, a colorful butterfly glides across the screen.

Monkey Business is the second in the Kickstand series of artist-created screensavers issued by antenna tool & die co., a New York outfit that produces and promotes innovative digital art. Priced at a collector-friendly US\$22.50, the Coe screensaver is a buy that's both practical and aesthetically pleasing, allowing art lovers and computerheads alike to experience, firsthand, both the computer as a valid new art form and some of the freshest ideas in contemporary art. – Reena Jana

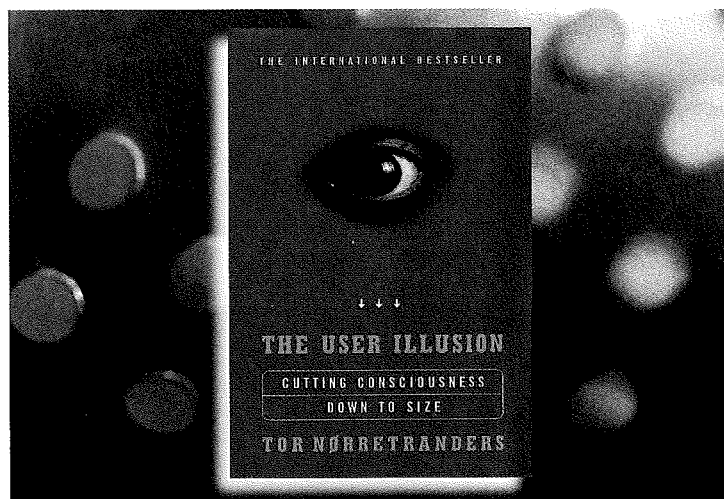
Monkey Business, by Sue Coe: US\$22.50. antenna tool & die co.: +1 (212) 343 2866, on the Web at www.atdc.com/.

Making Sense

Who are you? Answering this question can easily make you a victim of the old "I think, therefore I am" virus, precursor to the deadly Descartes syndrome. Hoping to inoculate the world once and for all from the dangers of this pesky meme is Tor Nørretranders, whose new book, *The User Illusion*, is intended to bring you to your senses. Literally.

Nørretranders, one of Denmark's leading science writers, cuts a wide and winding path through 20th-century intellectual history in his attempt to articulate what he sees as a fundamental shift in consciousness. Making stops at the houses of thermodynamics, Marxism, information theory, psychology, astronomy, and many others, the result is an arduous journey that's not for the faint of heart.

The book's title refers to the illusion that greets most digital machine users: the desktop – an imperfect and rather rudimentary mechanism that filters complex stimuli into recognizable patterns. Nørretranders equates consciousness with this computer metaphor, postulating that "consciousness is the instance of selection that picks and chooses among the many options nonconsciousness offers up." In other words,



One of Denmark's leading science writers takes on consciousness.

It's a sieve for all of the bits that constantly flit through our beings.

Nørretranders' real project, indicated in the subtitle, is *cutting consciousness down to size*, which he does by citing research that indicates there's a delay between the moment nonconsciousness registers something and the moment consciousness becomes aware of it. This obscure fact enables him to postulate that consciousness is basically a gatekeeper and, given things like Freudian slips, not a very adept one at that.

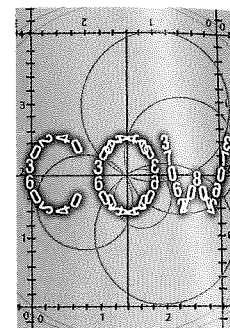
The author winds up his journey basking in the warm nonconscious glow of these slips and other messy life situations. Whether you, dear reader, will make it with him to his nirvana is unclear. You'll first have to get through lots of thermodynamic muck and philosophical thickets such as "Because everything is constantly being diluted by nothing, we can experience it as everything." In the end, you might feel like screaming, "Stop making sense!" Just remember, however, that Nørretranders' primary goal is to bring you back to your senses. – J. Schulz

The User Illusion: Cutting Consciousness Down to Size, by Tor Nørretranders: US\$29.95. Viking: +1 (212) 366 2000, on the Web at www.penguinputnam.com/.

Integral Domain

Web sites that allow users to slice up cones or tile planes or bounce rays off the inside of water droplets are not unique, so it was only a matter of time before serious math educators tested the online waters. That moment has arrived: Temple University's Calculus on the Web project takes a motivated student through the equivalent of a complete first-year college calculus course.

COW is a slick, elegant program. The help files are abundant and lucid. In many places AI routines analyze incorrect answers, figure out what you



Meet Professor COW.

did wrong, and try to restate the idea of the problem more helpfully. Teachers should note that the program has hooks for math courses or labs – it can keep track of lists, correct homework, and figure grades.

The site has inspired collaborative efforts by others. (One professor plans to write Statistics on the Web. Guess what it'll be called.) Perhaps in the future a herd of COWs will pull math out of the nerd ghetto to which it has been confined.

– Fred Hapgood

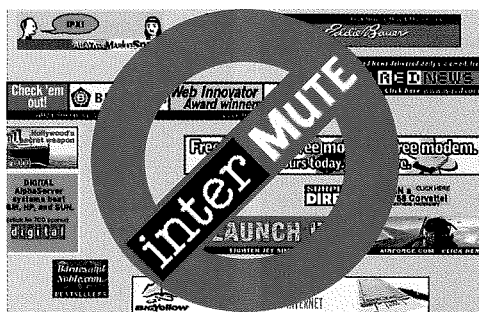
Calculus on the Web: free. COW: on the Web at www.math.temple.edu/~cow/.



Banner Buster

Ad-filtering software has been done before, but never this well. Previous filterware personified the antimarketing passion of its authors. Suspected HTML huckstering was stripped mercilessly from the incoming datastream, leaving crumbled pages onscreen. But interMute 1.1, a new release from one-man Internet Mute, is far more elegant. Probable ad images are not downloaded, but their space can be blocked out to preserve the designer's layout. Users can even opt to view the low-bandwidth ALT text. As a proud producer of both ads and ad-supported Web sites, I use interMute to proof page layouts without the ads in place.

This isn't just filtering software, though. It's an all-around bandwidth saver, with a user-friendly set of Web-page menus that allow custom sorting for a slew of pipe-clogging content types, from JavaScript to background music. interMute



Don't let those Java tickers slow you down.

can also block the privacy invasion of cookies and referrer information. Filtering is customizable by site and can be toggled on and off in a hurry. Barry Jaspán, the MIT graduate and Internet security consultant who says he developed interMute to get rid of "annoyances" that interrupted his work, also maintains a robust Unix version of the program on his Web site.

Web surfers may say they hate ads, but it's usually wasted time that upsets them. Tedious Java tickers and gratuitous GIF animations can tie up a computer in the middle of a deadline-driven data hunt. interMute provides orderly, personalized filtering of these bandwidth busters as needed. It's also one of the most reliable Windows Java applications I've used. Maybe Jaspán should give up security consulting to train the rest of us in programming. — Paul Boutin

interMute 1.1: US\$19.95, 14-day free trial. Internet Mute: +1 (617) 354 9471, on the Web at www.intermute.com/.

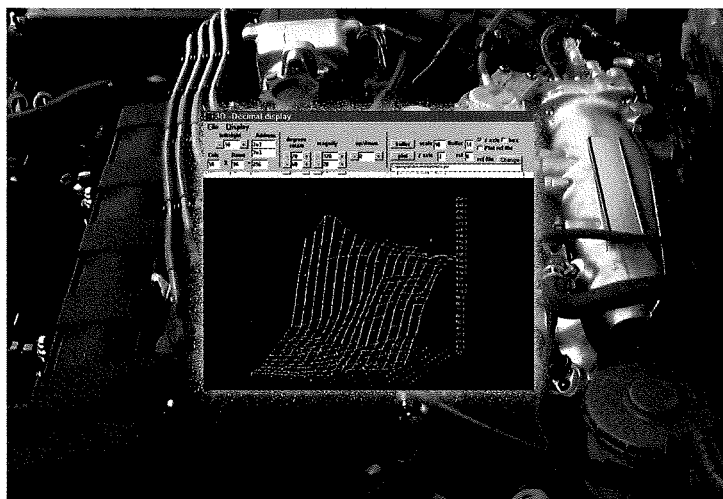
Digital Tune-up

Instead of waiting six months for a six-cylinder Volkswagen Passat, fans of Fahrvergnügen take their four-cylinder versions to chip tuners like Garrett Lim for a digital lobotomy. Garrett Integrated Automotive reprograms the electronic control module, aka the car's brain. Lim says most of his customers are amateur racers, but that doesn't stop the chips from being used on the street.

Even from the passenger's seat, the luxu-sedan felt nothing like the squishy-soft cruiser I'd test driven a few months earlier. Speedometer and tachometer needles jumped as though drawn by magnets once Lim removed factory-programmed limits on rpms and fuel injection. We reached 60 mph before using up second gear.

A dynamometer test showed a gain of nearly 25 horsepower. However, the real benefits are quicker throttle response, smoother acceleration, and more fun. A digital tune-up can yield better highway gas mileage, but it consigns the owner to a lifetime of pricey higher-octane fuel.

"There are 64,000 numbers, and you have to figure out which ones control what," Lim says. "The diagnostics will tell you when you've



Chip tuners put a whole new level of performance under your hood. exceeded the factory speed limits. But torque is better for the street than just horsepower."

For DIY types, Lim sells a US\$5,000 programming package called Super HexWin. Chip-based modules can be removed with little more than a screwdriver and mailed to Lim for alterations that cost a few hundred dollars. Changing the chip's factory settings can void a manufacturer's warranty, but that hasn't affected Lim's thriving business.

Because of Europe's warp-speed highways and lenient air-quality regs, autos coming into the US have been detuned, which leaves as much as 30 percent of their performance untapped. Tuners and customers often meet via Usenet, where one poor soul wanted to tone down the performance of a 1990 Ford Mustang that accelerated too fast because it had been a police car.

It's not all about power, though. Sometimes control is the ticket. Lim says he once set a car's chipset with a 55-mph limit for a worried parent. — David J. Wallace

Super HexWin: US\$5,000. Garrett Integrated Automotive: +1 (215) 547 7524, on the Web at www.dvol.com/~users/gal/giac.html.

JARGON WATCH

BERLIN FIREWALL

An Internet gateway that allows only the most basic port operations (mail, Web, limited news). Usually run by retentive sysadmins who hate the idea of anybody actually telnetting anywhere.

DEFRAGMENTING THE OFFICE

Cleaning and organizing your office in a desperate attempt at making sense of it all. "The servers I ordered didn't show up today, so I spent the afternoon defragging the office."

EXTREMOPHILE

An organism that can live in conditions of heat, radiation, or toxicity normally considered inhospitable to life.

PSEUDO-SUPERVISOR

A federal employee who's neither rank-and-file nor



a full-fledged supervisor (i.e., someone with all of the responsibility and none of the authority or appropriate compensation of a supervisor). The Feds have recently begun using the more dignified-sounding "team leader."

SHIPPER

(Short for "relationshipper.") A viewer of a sci-fi or fantasy TV show (*The X-Files*, *Star Trek*, *Babylon 5*) who writes erotic fiction about fantasized relationships between the show's stars. Similar to the older fan-fiction term *slash*, for imagined homoerotic pairings (as in Kirk/Spock).

A tip o' the batter's helmet to Simon Forrester, James Giusti, Michael Oliver, and Vince Pugliese.

— Gareth Branwyn
(jargon@wired.com)

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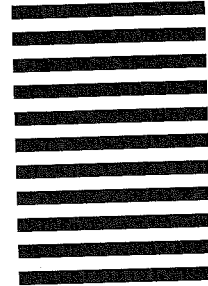
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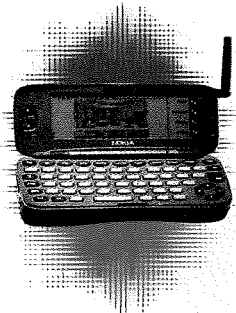




Power in Hand

Instead of carrying a cell phone, a PalmPilot, and a laptop computer, just slip a Nokia 9000i Communicator into your coat pocket. From the outside, the 9000i looks like a slightly oversize wireless phone. But pop the cover and you'll find a full QWERTY keyboard, 16 special-function keys, and a very readable bitmap display. All in just 14 ounces!

Like a Pilot, the 9000i has a full address book and calendar built in, with 8 Mbytes of memory. But unlike the Pilot, the 9000i allows you to find



It looks like a phone ...

the name, press Call, and talk to the person without added effort. The 9000i's Web browser supports SSL encryption, and its email client can check both POP and IMAP mailboxes.

Inevitably, the phone has some problems. The antenna can't be retracted, the battery generally lasts only half a day, and the match-book-sized charging adapter is small enough to lose. — *Simson Garfinkel*

Nokia 9000i Communicator: US\$999. Nokia: on the Web at www.nokia.com/.

Street Academy

It was his skepticism of academic and mainstream cultural criticism that drove Joshua Glenn to create a zine that gives a voice to indie intellectual thought. *Hermenaut* — which calls itself “The Digest of Heady Philosophy” — is a scholarly journal minus the university, a sounding board for thinking folk who operate outside the ivory tower.

As if to underscore his point, Glenn offers his noncredentials: Not only is there no PhD after his name, but titles accumulated during the years he's been publishing include bartender, carpenter, substitute teacher, and zine-plugging review editor at *Utne Reader* (a job he later quit because “it was still, after all, *Utne Reader*”).

Produced while Glenn was living in a mountain cabin, double issue #11/12 is all about camp. The claim — that distinctions between camp and related aesthetic categories get mismatched by the mainstream culture critics so anathema to *Hermenaut* — is enforced in this issue by a boatload of embarrassing examples. To elucidate just what's



Joshua Glenn explores the world outside the ivory tower in *Hermenaut*.

being confused here, four similar, but discrete, categories of aesthetic are defined: There's the engaged irony of camp (a Dolly Parton-impersonating drag queen), kitsch (the faux-classiness of Liberace), cheese (feigned love of the polyestered *Brady Bunch*), and trash (any John Waters film). In 186-plus pages of discourse, *Hermenaut* makes clear why wiggers and *Mystery Science Theater 3000* are culturally insulting at best; how camp was killed by Valerie Solanas, the feminist writer who failed to assassinate Andy Warhol; and how the philosophy behind Oscar Wilde's life and writing is most exquisite High Camp.

And what is a hermenaut, exactly? Glenn says his coinage is a combination of *hermeneutics* and *astronaut*, or “someone who adventurously makes meaning and engages in philosophical inquiry in a highly unusual manner outside of the academy.” Word. — *Michael Stutz*

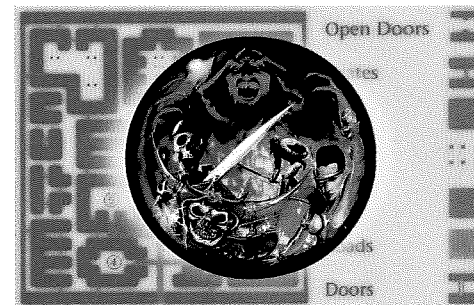
Hermenaut: The Digest of Heady Philosophy: US\$6 single copy, \$20 four issues. *Hermenaut*: +1 (617) 254 5217, on the Web at www.birdhouse.org/hermenaut/words/.

Remembrance of Things Past

Nostalgia, they say, is a thing of the past. But in a world in which the phrase “That's sooo two minutes ago!” is spoken with continually less irony, a little nostalgia is often welcome. *The Ultimate RPG Archives* is a time machine on five CDs, a gateway to the days when men were real men, computers were 8-bit, and “automap” was a mispronunciation of a famous deli in New York City.

Of the 12 games collected here, all but one (*Stonekeep*) truly deserve the term *classic*. Half date to the mid-1980s and feature 16-color (that's color, not bit) graphics, PC speaker sound, and the much welcome absence of cinematic cut scenes. You want cut scenes? Read the numbered paragraphs when you're told to, fanboy. (That's what we had for cut scenes in my ill-spent youth, and we liked it that way!)

Those of you used to modern games — thin on depth, thick on bells and whistles — will be either pleased or distressed by this anthology, depending on your tastes. You will also be introduced to



Settle down to the joy of classic role-playing games. the joys of boot disks and the alphabet soup of EMS, EMM, XMS, IRQ, et cetera.

A couple of early problems: While a thick tome reprinting some of the original manuals accompanies the set, it's missing some key components — maps and vital background info for solving some of the games, not to mention answers to in-game riddles, a form of early copy protection.

My recommendations: *The Bard's Tale Trilogy* for major-league munchkin hack&slashing, *Dragon Wars* or *Wasteland* as an example of the best 8-bit games, and *Ultima Underworld I* to see a program doing most of what *Quake* does, eight years earlier.

If you can get out of that latest&greatest& flashiest&coolest mindset and settle down to actually playing a game, you'll find there's a lot more enjoyment in just one of these clunkers than in any 10 *Quake* or *Warcraft* knockoffs.

— *Lizard*

The Ultimate RPG Archives: US\$39.95. Interplay Productions: +1 (714) 553 6655, on the Web at www.interplay.com/.

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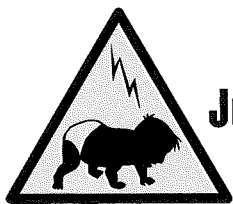
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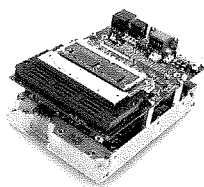
Just Outta Beta

By Jesse Freund

Curiously Strong Computer

For people who like to get down and dirty, the new Mighty Mite is a 4- by 5.75- by 1.1-inch single-board computer featuring a 200-MHz Pentium processor with MMX technology — in other words, a PC about the size of a 3.5-inch hard drive that can run Windows NT. Of course, you have to be willing to eschew luxuries such as an enclosing case and power supply, but for sheer size and power you can't beat the Mighty Mite.

Release: August. Cell Computing: +1 (408) 967 8800



Bionic Ear

Traditional hearing aids simply amplify sound — creating a cacophony of mixed noises inside a wearer's ear. Even most digital hearing aids do little more than filter out background noise. But the new Cetera hearing aid — which includes a customizing algorithm — actually restores the brain's ability to locate a sound's starting point and allows the wearer to focus on a single voice in a noisy room.

Release: early fall. Starkey Laboratories: +1 (612) 941 6401.

A Global Calling

While roughly half of the world's population has yet to make a phone call, the much anticipated arrival of satellite telephony will soon allow globetrotters to make digital wireless calls atop Mount Everest, in the middle of the Sahara, and almost anywhere else on the planet. Sat phones may eventually connect the phoneless masses, but not before the stratospheric prices fall enough to entice consumers on Main Street.

Arriving September 23, the Motorola-backed Iridium system becomes the first handheld sat-phone service to hit the market. Iridium effectively blankets the globe with wireless service by augmenting existing cell networks with a web of 66 low Earth orbit satellites. The first-generation



service will concentrate on voice transmission and paging, while Macrocell, a high-bandwidth system, will arrive a few years hence.

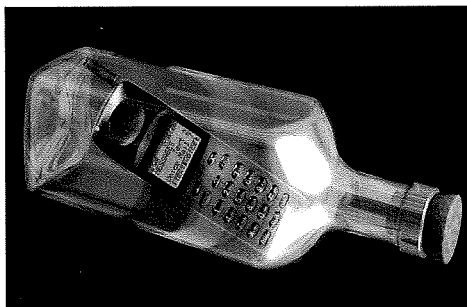
Initially, Iridium's service will cost 30 percent more than cellular rates and the phones themselves will run US\$2,500 to \$3,000 a pop — all that for calls with an uncomfortable quarter-second of latency. Competition from rival systems such as Globalstar and ICO — arriving in the next few years — should eventually drive down prices and improve service, but in the meantime only international men of mystery, well-heeled foreign correspondents, and other global trendsetters will have the convenience of untethered worldwide communication. — *Tim Dickinson*

Release: September. Iridium: +1 (602) 752 1100.

Ring-Free Zone

"As telecommunications appliances become smaller and cheaper, people use them anytime and everywhere," says NetLine Technologies marketing VP Gil Israeli. "The result is that cellular operators make a fortune and our quality of life deteriorates."

Choosing to outsmart those service providers, the Israel-based communications company NetLine has introduced C-Guard, a device that blocks cell-phone use in an enclosed area and creates a predefined ring-free zone. The tiny wall-mounted gadget can be used to keep movie theaters quiet, prevent electromagnetic interference on airplanes and in hospitals, and enforce call-free zones on military bases, where eavesdroppers might tap security-sensitive conversations.



In fact, the engineers at NetLine learned to combat unwanted communications while serving in the Israeli army. And the technology, which works by blocking a handset's communication with a service provider's base station, reflects this training as well as Israel's infatuation with cell phones. When you ask the folks at NetLine what they think of the Holy Land's cellular obsession, you get an opinion that is becoming increasingly prevalent across borders.

"The need for regulation of cell-phone usage will increase dramatically," says Israeli. "The public will demand adequate solutions that require cellular operators to exercise more control over their services." In the meantime, NetLine's solutions allows you to take matters into your own hands.

Release: late summer. NetLine Technologies: +972 (3) 574 6756.

Muscle Cars

It's hard to get the feel for car racing on a computer keyboard, but *Trans-Am Racing '68-'72* tries awfully hard to achieve realism. Gamers choose from among 13 muscle cars — including Camaro, Dart, or Mustang models — and compete on 12 authentic road courses. Accidents are rendered on the fly, instead of in typical preanimated sequences. And players must negotiate the pit stops with as much skill as they use on the courses.

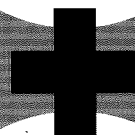
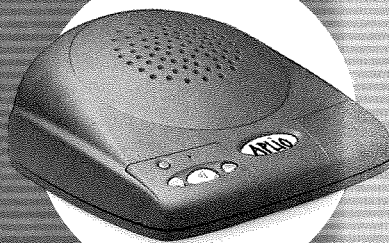
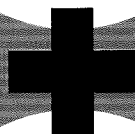
Release: September. GT Interactive Software: +1 (212) 726 6500.



Info Armageddon

Cyberwar may lack the immediate body count common in conventional warfare, but its implications are still devastating — especially for the American way of life. *The Next World War: Computers Are the Weapons & the Front Line Is Everywhere*, a new book by James Adams, explains how the US government's reliance on digital technologies has altered the global balance of power. The former Washington bureau chief for the London *Sunday Times* claims that US techno-dominance puts the country in a position of both privilege and extreme vulnerability.

Release: August. Simon & Schuster: +1 (201) 767 4990.



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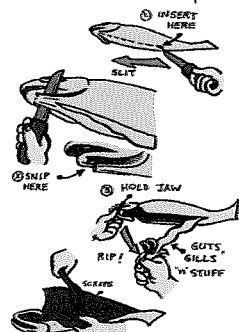
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Cure for Cluelessness

Learn2.com reminds me of a popular quote from the late sci-fi author Robert A. Heinlein: "A human being should be able to change a diaper, plan an invasion, butcher a hog, conn a ship, design a building, write a sonnet, balance accounts, build a wall, set a bone, comfort the dying, take orders, give orders, cooperate, act alone, solve equations, analyze a new problem, pitch manure, program a computer, cook a tasty meal, fight efficiently, die gallantly. Specialization is for insects."

Out of Heinlein's 21 require-



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ments for membership in the human race, *Learn2.com* will teach you only two: how to change a diaper and balance a checkbook. (Three, if carving a turkey is close enough to "butchering a hog" for you.) But you'll also learn a lot of other things that will keep you from becoming a hive insect: how to hide things at home, open a coconut, shuck oysters, patch a hole, and sell your car.

Avoid the fate of Gregor Samsa — regular visits to this site will keep unsightly metamorphoses at bay.

— Mark Frauenfelder

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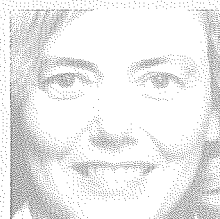
ON THE BOOKSHELVES OF THE DIGERATI

KATHLEEN EISENHARDT

coauthor of *Competing on the Edge: Strategy as Structured Chaos*, is a Stanford professor, mother, and avid skier.

***A Thief of Time*, by Tony Hillerman.** "I enjoy a book that surprises me. This is a great mystery set in the Southwest about the disappearance and death of an archaeologist. The story twists and turns; the characters are complex and realistically flawed. And there's something haunting about the Southwest; I think it's the mix of the Indian culture with the Anglo culture in the starkness of the desert."

***Sense and Sensibility*, by Jane Austen.** "I like Jane Austen because I think the



language is fabulous. Her vocabulary and turns of phrase are more sophisticated and fun. It's English at its highest form. I don't think you see that very often anymore. Austen inspired me to upgrade my syntax and sense of style when I was writing my book."

***The Quark and the Jaguar: Adventures in the Simple and the Complex*, by Murray Gell-Man.** "I like the elegance of science, and this is a book that melds two different and complex fields — quantum physics and evolutionary biology. It's written for the layperson who likes deep science books. I alternate between mysteries and Austen-like books before bed, and I save this for when I'm on vacation."

DOUGLAS ADAMS

wrote *The Hitchhiker's Guide to the Galaxy*, which he is adapting into a screenplay.

"Generally speaking, I don't read much fiction. We used to turn to the big novel for insights into the big questions of life. Most literary novelists now don't know anything about this stuff, which is why I turn to the life scientists. They are thinking more profoundly about the nature of the human condition by shining the light into the depths of what it means to be human."

***The Origins of Virtue: Human Instincts and the Evolution of Cooperation*, by Matt Ridley.** "For a long time people said that science can self-evidently have



nothing to say about morality. Ridley makes it clear that out of evolutionary theory and its offshoots scientists are getting close to being able to say intelligent things about ethical issues. People believe they apprehend the world in a rational way. This is a wonderful illusion that we practice on ourselves."

***The Evolution of Cooperation*, by Robert Axelrod.** "Axelrod was the guy who first made solving the prisoner's dilemma into a computer game. This sort of research couldn't have been done before the advent of computers. Everything until now has been the process of taking things apart to see how they work. The coming of the computer has enabled us to start putting things together."

JANICE GJERTSEN

cofounded *Total New York*; she is now in business development at Digital City. She also hosts the *New Media Roundtable Dinner Series*.

***From Power to Partnership: Creating the Future of Love, Work and Community*, by Alfonso Montuori and Isabella Conti.** "This book opened my eyes to how powerful a true partnership can be. Every page is full of insights shifting how I typically look at a partnership, including one with yourself, which I think people forget about. The same dynamic threads through all types of relationships."

***Grooming, Gossip and the Evolution of Language*, by Robin I. M. Dunbar.** "Com-



munity is still such a buzzword. I see it in many business plans based on creating tight communities of more than a million people. Dunbar points out that in today's evolutionary path we can't form communities of more than 150 people. I don't know when that number will grow."

***Understanding Comics: The Invisible Art*, by Scott McCloud.** "This is a must-read for any Web designer. McCloud talks about what happens between the frames in a comic strip. We don't think about that when we build Web sites. We still have a page-by-page mentality. We don't look at what experience people are having between the pages. McCloud had no idea that he wrote this book for this media."

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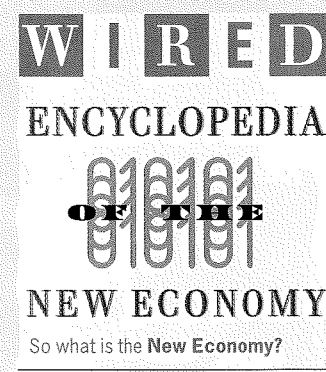
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Antipop

In this day and age, the typical trajectory of a pop career goes something like this: The first album achieves cult status, the second climbs higher in the charts, past hits are then used in sports commercials, and the third album dooms the act to a career of overly commercial proportions.

Not if you're Massive Attack – you'll be running hell-bent for leather in the other direction. *Mezzanine*, the band's third studio album, explores emotions darker than the bubblegum it could have embraced. As such, it isn't likely to win new fans who prefer



Massive variety.

their music easily digestible.

Few groups hold production standards high enough to support several vocalists. This flexibility has been a hallmark of Massive Attack's career, from Shara Nelson's heavenly takes on songs like "Safe from Harm" to Tricky's sexy draws on "Daydreaming" to the purity of Tracey Thorn's "Protection." *Mezzanine* also features stunning vocal guest performances, but get ready to be challenged on the musical front. — Tamara Palmer

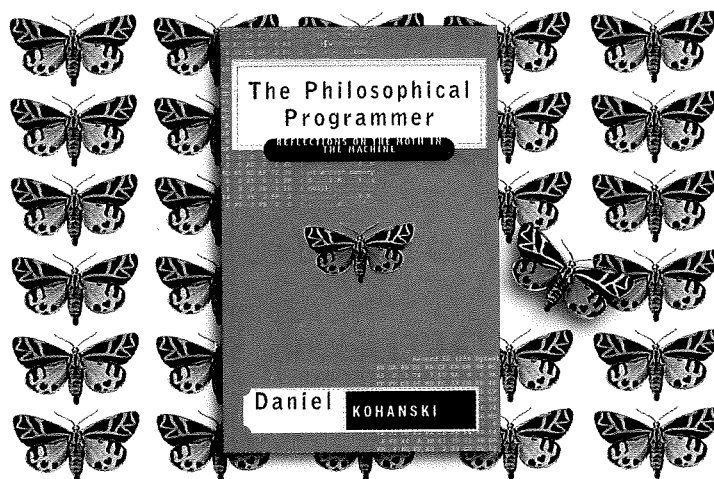
Mezzanine, by Massive Attack: US\$17.98. Virgin Records: on the Web at www.virginrecords.com/.

Binary Zen

One morning in September 1944, the Harvard Mark I – a precursor of modern computers – suddenly malfunctioned. Engineers spent hours investigating the problem, only to discover a moth fried to a relay. Thus, according to Daniel Kohanski, a computer programmer with Bank of America, the ubiquitous catchphrases "there's a bug in the machine" and "debugging" entered the computer-programming lexicon.

This historical tidbit resides at the ideological center of *The Philosophical Programmer*, Kohanski's ruminations on the art and exercise of programming. The main thrust of the book is that in their 40-year history, computer programmers have failed to fully understand their trade, an ignorance that has had definite and serious ramifications in the real world. A bank teller enters *none* into a terminal, and suddenly several thousand checks are sent to None, Wisconsin. Or a weaponry system mistakes a passenger jet for an enemy. These are just two of the "moths" that have found their way into computer code over the years due largely, Kohanski accuses, to sloppy writing.

As its title suggests, this book is intended to provide "philosophical" insight, and Kohanski does begin with chapters on traditional



Daniel Kohanski gets inside the bugs of programming.

philosophical questions of aesthetics and ethics. The idea that an aesthetics of programming might exist is intriguing. Unfortunately, the author's thoughts on this never gel beyond the simple adjuration to create "efficient" programs. Likewise, a chapter on ethics presents rather hackneyed views on privacy issues, viruses, and the computer as an alienating force – topics often better explored elsewhere.

Kohanski is at his best when he's analyzing actual programming languages. In a long middle section he distills the trade's history into its most notable developments. And yet, as intellectually impressive as object-oriented languages like C++ and Java are, Kohanski observes, all synthetic languages lack the ineffability or vagueness that characterize how humans actually communicate and think. The cultural and historical nuances that have shaped our brains are missing from the world of "mathematized information." "Fuzzy logic" programs are a step in the right direction, says Kohanski, but, judging from his work, it seems the dilemma can never be fully addressed by better programs. That's a job for better programmers. — Paul Bennett

The Philosophical Programmer: Reflections on the Moth in the Machine, by Daniel Kohanski: US\$22.95. St. Martin's Press: (800) 288 2131, on the Web at www.stmartins.com/.

Contributors

Paul Bennett (sadie@el.net) haunts Manhattan's Lower East Side and arranges words for sundry periodicals.

Jackie Bennion used to be a passionate skeptic living in London. Now she's a cheery optimist living in California. She still doesn't know which is better.

Colin Berry (colin@wired.com), a *Wired* contributing editor, drinks espresso and writes as-yet-unpublished short stories in San Francisco.

Paul Boutin has graduated from software engineering to reverse engineering as a producer and writer for *Wired Digital*.

Richard Dean founded NPR Online and is a commentator for National Public Radio's *Weekend Edition – Sunday*.

Mark Frauenfelder (mark@well.com) is editor of *BOING*, a magazine of fun and activities for higher primates.

Simson Garfinkel writes about computer security and usability. In his spare time, he runs an ISP on Martha's Vineyard.

Phil Hall is an okapi at the Bronx Zoo.

Fred Hapgood (hapgood@pobox.com) is a freelance writer specializing in science and technology.

Reena Jana (reena@sirius.com) contributes to *The New York Times Magazine*, *Flash Art*, and *Artforum*. She needs constant visual stimulation.

Lizard has been active online since 1987 and a CRPG player since 1981. His online time is split between fighting censorship and fighting orcs.

Tamara Palmer (trance@netcom.com) is a coeditor of *URB*, daredevil in-line skater, living-room DJ, and budding horticulturalist.

Jef Raskin (www.cfcl.com/jef/ or jefraskin@aol.com), best known for creating the Macintosh project at Apple, now consults and is busily finishing up a book on interface design.

J. Schulz is a writer, artist, and manager of Internet content/new media at the American Stock Exchange.

Michael Stutz (stutz@dsl.org) is a writer. His first novel, *Sunclipse*, has been released as freeware.

David J. Wallace writes from Philadelphia for *The New York Times* and several magazines concentrating on business, technology, and international trade. No, really.

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Laptops

First Class:

ThinkPad 770ED

The ThinkPad 770ED keeps you going all week long. One day you're delivering a client presentation on its monster 14.1-inch screen, the next you're using Windows NT apps over the office network. When the weekend approaches, sneak the laptop home to show your family DVD movies, taking advantage of the MPEG-2 chip, Dolby Digital sound, and S-Video port to the TV.

ThinkPad 770ED: US\$5,799. IBM: (800) 426 7255, on the Web at www.ibm.com/.

Business Class:

GoBook

With laptop makers in a frenzy over the battery-sucking Pentium II chip, it's time to regain focus. Portables, after all, are for portability. Micron's radically sensible GoBook gets back to basics with a long battery life (up to 11 hours) and a light load in your luggage (either 4.5 pounds or 6.75 pounds with extra battery).

GoBook: US\$3,299. Micron Electronics: +1 (208) 898 3434, on the Web at www.gobook.com/.

Coach:

Compaq Armada 4131T

Trust us: Look to the twilight of every Compaq product cycle, where you'll discover the best for less. For example, last year the bright-eyed 133-MHz Armada 4131T set forth at US\$4,299. Today, it costs about 900 bucks. As more of the company's quality laptops wash up on the sub-\$1,000 shore, you should be there to scoop them up.

Compaq Armada 4131T: approximately \$900. Sold through MicroWarehouse (www.microwarehouse.com/), PC Connection (www.pcconnection.com/), and other mail-order houses.

Roof Racks

First Class:

Porsche Roof Transport System

Because roof rack design hasn't changed much during the last five years, the curvaceous new Porsche setup truly stands out. Custom-built for the Boxster, this carrier follows the automobile's contours for reduced wind noise – with the top on or off. Of course, you have to own a Boxster to use it, but that seems a small price to pay.

Porsche Roof Transport System: US\$590 (car not included). Porsche: on the Web at www.porsche.com/.

Business Class:

Yakima

Whatever your sport, Yakima has a way to carry the gear. The new versatile AnkleBiter bicycle mount, for example, fits (finally) full-suspension and BMX bikes. Another accessory, the HullyRoller, lets you strap a sea kayak on the roof without breaking a sweat. But the rowing is all you.

Yakima base rack: US\$176 to \$231, plus accessory mounts. Yakima: +1 (707) 826 8000.

Coach:

HandiRack

A blow-up roof rack? Delcor's versatile HandiRack includes two inflatable tubes, made of laminated PVC, that take shape with a little pumping or puffing. Flaps at the ends of the tubes fasten inside the car, and tie-downs secure skis, bikes, or even lumber. The HandiRack is cheap and easily removable, and it fits neatly in your trunk.

HandiRack: US\$89.95. Delcor Industries: +1 (303) 979 7175.



Kiddie Pools

First Class:

Sevylor Oval Pool

Lounging poolside takes on a new meaning with the Sevylor, a swank inflatable number with sides sturdy enough to sit on. Just 8.3 feet long and 21 inches deep, this swimming hole is made from heavy-gauge PVC – ideal for when that game of Marco Polo gets a bit crazy. Pick up the electric inflator and almost 200 gallons of summer relief are just minutes away.

Sevylor Oval Pool: US\$149. Electric Inflator: \$49. Sharper Image: +1 (415) 445 6000.

Business Class:

Step-Up Slide/Big Splash Center

Cranky toddlers can cool more than their heels in this water wonderland. Geared toward kids ages 1½ to 5, Step2's slide/pool combo is made of heavy-duty plastic. The steps are even treaded so that Junior won't slip while scrambling to be next down the 4-foot chute.

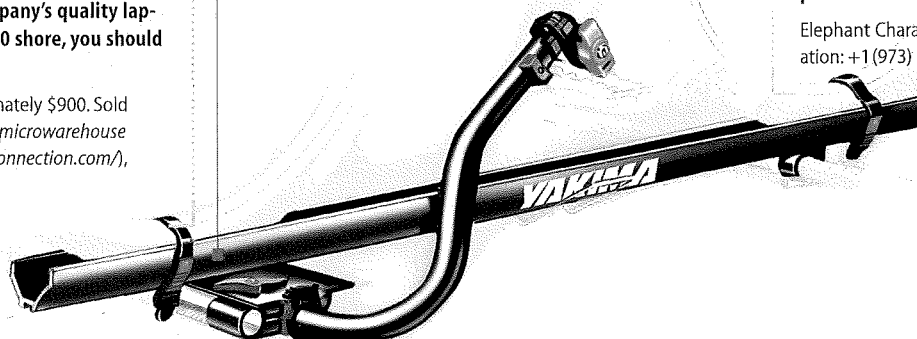
Step-Up Slide/Big Splash Center: US\$115. The Step2 Company: +1 (330) 656 0440, on the Web at www.step2.com/.

Coach:

Elephant Character Spray Pool

You just can't beat a giant purple plastic pool in the shape of a pachyderm. A garden hose fits in the beast's snout to make a splash in this mini water world. What's more, the elephant's schnozzle is strong enough to hold a young child. Made of high-density polyethylene, the 60-inch-wide pool has room for the whole gang.

Elephant Character Spray Pool: US\$20. Pelican Recreation: +1 (973) 898 1299.



TECHNOLOGY

LG makes it work better



Electronics

WE PUT PEOPLE FIRST

Technology today doesn't stand still. Neither do we. At LG Electronics, we're always working to deliver better products and higher performance. Products like our revolutionary new Flatron™ monitor. With its geometrically flat screen, it eliminates distortion and reduces glare up to 25% over conventional flat square screens. Or our high-speed, high-capacity CD-ROM and DVD-ROM drives. Or our more powerful, more portable Phenom Handheld PCs. At LG Electronics, we have people all around the world making technology more efficient and more affordable than ever before. See how LG is making it work for you. Call 1-800-243-0000 or visit www.lgeus.com.



September 17-19 Portland Creative Conference Portland, Oregon

From gargantuan Powell's City of Books to Gus Van Sant, the cultural import of the riverside city of Portland has been extensive. It's here that a dozen big names meet every year to share their thoughts on creativity in film, television, advertising, and new media. Van Sant will speak about his directing canon - from *Drugstore Cowboy* to last year's *Good Will Hunting*. *The English Patient* producer Saul Zaentz and performance artist Denny Dent will talk about what drives their art. Celebs suffer Q&A sessions gladly, take part in panels with other artists, and sometimes mix with the crowd over gin-and-tonics.

Tête-à-Tête Potential ★★
Geek Factor ★
Idea Takeaway ★
Star Power ★★

Registration: US\$495 through August 30, \$595 thereafter. Contact: (800) 597 0099, on the Web at www.cre8con.org/.

September 23-26 ICES'98 Lausanne, Switzerland

Many conclaves touch on the software side of creating evolutionary machines, but the International Conference on Evolvable Systems deals with actual hardware. One focus of the event, and the engine of evolvable hardware, is the field programmable gate array, or FPGA, a chip whose many logic gates can be reconfigured depending on the result of software trials. In the lab, the FPGA gets smarter after each test run. ICES attendees can also enter a US\$1,000 contest to create and demonstrate a self-replicating gadget - mechanical or electronic.

Tête-à-Tête Potential ★★
Geek Factor ★★
Idea Takeaway ★★
Star Power ★

Registration: SwF450 (US\$300). Contact: +41 (21) 6932652, fax +41 (21) 6933705, on the Web at <http://www.epfl.ch/ices98/>.

September 15-17 Telecosm Lake Tahoe, California

Qwest's Joseph Nacchio, Bay Networks's David House, Oracle's Larry Ellison, IDG's Robert Metcalfe, and too many other heavyweights to mention are scheduled to wrestle with George Gilder's prolix metaphors at this meditation on the marriage of silicon and fiber. Titled "Bandwidth Blowout" and presented by Gilder and *Forbes*, this conference assumes a world of unlimited bandwidth. Qwest's rise is big-time proof of concept for packet-switched networks, but which company will take Intel's place as a high tech titan and become the brains of tomorrow's network? Is it any wonder organizers chose Lake Tahoe, a favorite lair of the Godfather in Coppola's films?

Tête-à-Tête Potential ★★
Geek Factor ★★
Idea Takeaway ★★
Star Power ★★

Registration: US\$3,950 (by invitation only). Contact: +1 (212) 499 3521, fax +1 (212) 499 3324, on the Web at www.forbes.com/conf/.

October 5-9 Fall Internet World New York City

Picture yourself coming home from Fall Internet World. The takeaway: sore feet and a worn-out plastic bag full of demo CDs. But you'll probably have scrawled some good notes from the Web Developer's Summit or brought back some intriguing ideas from the Enterprise Internet Forum. The sponsor, Mecklermedia, has focused its biggest event of the year on the business side of the Net - with 50,000 Web pros at the show and keynote addresses as intimate as arena rock. But with headliners including Sun's John Gage, AT&T's C. Michael Armstrong, and Netscape's Jim Barksdale, you'll be as glad that you went as you are that it's over.

Tête-à-Tête Potential ★★
Geek Factor ★★
Idea Takeaway ★★
Star Power ★★

Registration: US\$1,395. Contact: (800) 632 5537, on the Web at www.internet.com/.

October 9-11 CPSR Annual Conference Cambridge, Massachusetts

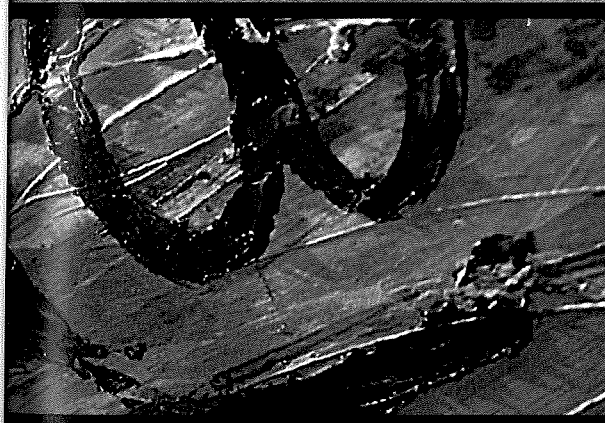
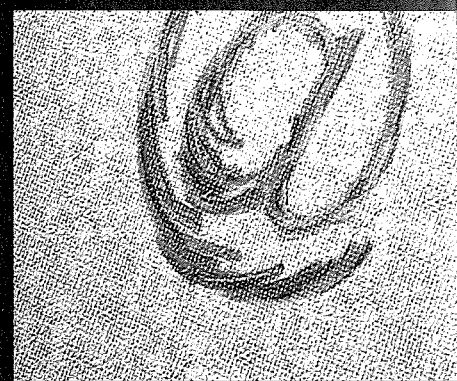
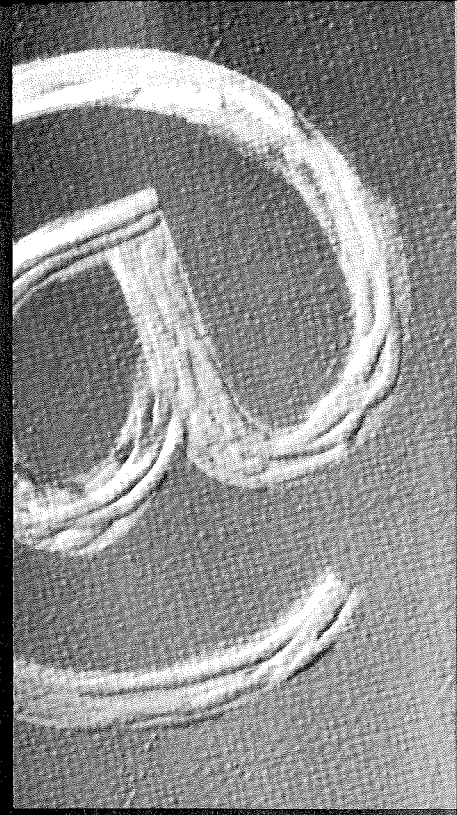
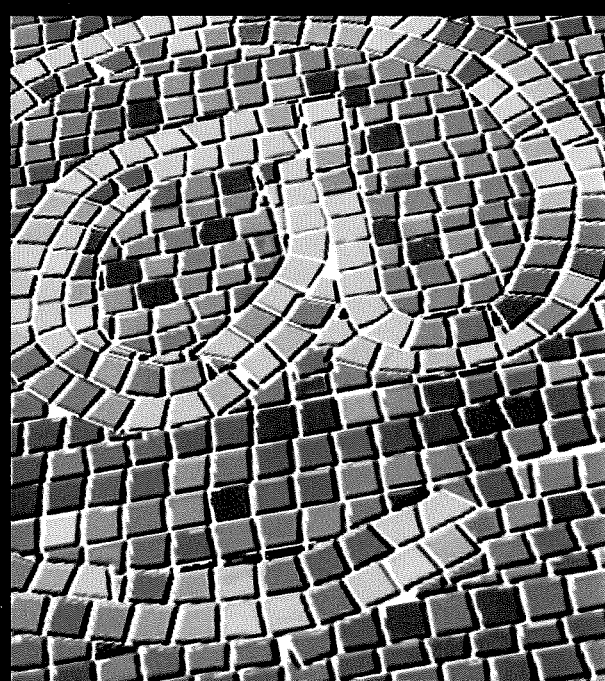
Public television once promised to carve out a space for the public interest. And now, as the Internet morphs into a profit-driven zone, Computer Professionals for Social Responsibility aims to define something like a PBS for the Net. "In reality, PBS didn't work out to represent the public voice in TV," explains CPSR executive director Duff Axsom. "But one of the things we're trying to ask is: What part of this territory do we need to stake out? It's not so much against the commercial interests, but what are the interests of the people who're not represented?"

Tête-à-Tête Potential ★★
Geek Factor ★
Idea Takeaway ★★
Star Power ★

Registration: US\$100. Contact: +1 (650) 322 3778, fax +1 (650) 322 4748, on the Web at www.cpsr.org/.

Send event information to junks@wired.com.

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ness and enterprise. The Smau of image and entertainment. The Smau of new products, awards and great previews. The Smau of culture and conferences.

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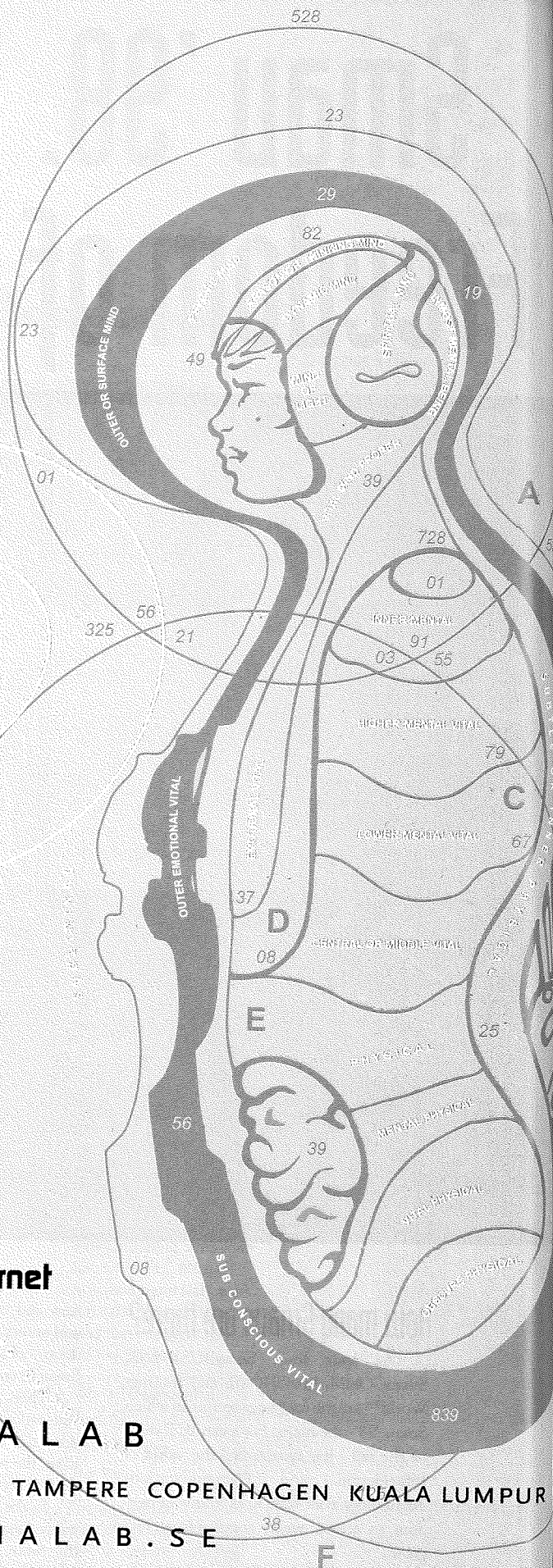


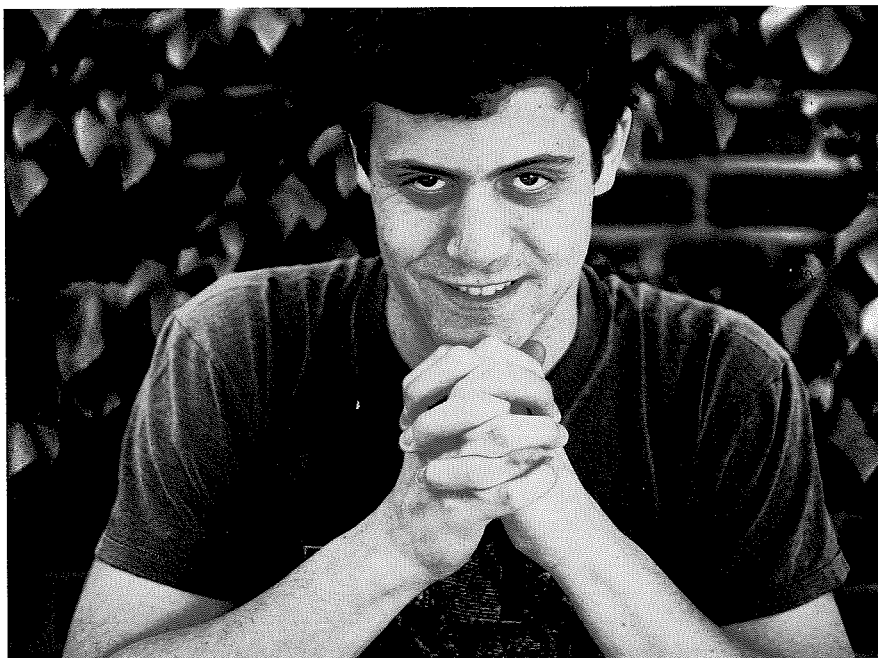
IMAGE: GIRL RAY

Software

King of Clubs

A social as well as a financial phenomenon, the surging '90s stock market has become one gigantic bull session: In the first four months of 1998, nearly 5,000 new investment clubs were formed. With a new software package called InterClubs, the party's going to get even more crowded.

InterClubs enables investors to form investment-club Web sites that are highly customizable and, crucially, fully private. The idea came about when Roddy Scheer, a prospering principal at the New York Web-design firm Reflector Group, wanted to talk stocks with college friends around the country. He started up an email list, but the frustration of being unable to combine the listserv's discussions with the Web's wealth of stock data gave Scheer, 28, the urge to merge them. The resulting virtual club, called Mucho Dinero, made some good picks,



InterClubs's Scheer: Talk amongst yourselves.

including WorldCom and a pre-Viagra Pfizer. Scheer saw he was onto something.

Using InterClubs, an investor interested in semiconductors can set up a group with chip-biz pals in Phoenix and Seoul – before long, participants are plotting tactics in the discussion rooms and tracing the market's movements with the built-in portfolio tools. And, unlike conventional bulletin boards, the rooms are secure and members-only – essential for discussing sensitive portfolio matters online.

InterClubs is still a work in progress. Its portfolio tracking screens, for example, list only rudimentary quote info. But pending deals with Excite and other Web heavyweights will enrich the data InterClubs gets to play with. A Quicken arrangement could even bring tax-filing software into the package – handy when it comes time to figure your club's capital gains. – *Charlie Vestner*

InterClubs: on the Web at www.interclubs.com/.

Stock Ideas

Testing, Testing

Drug patents' limited shelf life – 17 years in the US – means pharmaceutical companies are constantly racing the clock to get new products to market. Conflicting international regulations don't make the task any easier. Increasingly, the big pharmcos are buying help from contract research organizations (CROs), which specialize in testing new drug products (see "Smart Pharmar," page 81).

If you've got a hot new pill prospect, the reasons to use CROs are clear. Because they already have the right equipment and up-to-the-minute regulatory know-how, CROs can often complete tests half a year sooner and 15 to 25 percent cheaper than firms like Merck or Glaxo, according to Arda Minocherhomjee, a health-care investment analyst at William Blair & Company.

Minocherhomjee's CRO favorites include Covance (CVD) and Quintiles Transnational (QTRN), whose 1997 sales of more than US\$800 million make it the industry's titan. Analysts following QTRN expect it to earn \$1.02 per share this year, up 36 percent from 1997 – a rate they think it can sustain for the next five years. – *Steve Bodow*

Career Opportunities

Hedge Your Bets

Fantasize about playing the market with other people's money? It doesn't have to be a fantasy. The number of hedge funds – that's financeese for private investment partnerships – has grown from 1,400 to 5,500 worldwide in the past decade, according to George Van, chair of advisory firm Van Hedge. Today funds are run by former engineers, journalists, and entrepreneurs of all stripes. Anyone can do it.

Hedge funds are open mainly to a limited number of accredited (read: wealthy) investors, who presumably have a sophisticated understanding of risk. Hedge managers are thus exempt from the federal laws designed to protect mutual-fund shareholders and can dip far deeper into a bag of financial tricks – like building big short positions, investing in private companies, or playing the options game. On average, according to Van, this riskier approach produces better returns than mutuals.

Add to this fat fees – the industry standard ►

"A year ago, a friend of mine was looking for land along Onion Creek, and it was \$10,000 per acre. Now it's \$20,000 an acre. My friend asked his broker, 'What in the hell's going on?' She said, 'High tech people.'"

— James "Tex" Steeg, president of Avenue One Properties, on Austin-area real estate

► is a 1 percent management charge on top of a 20 percent profit cut, far better than most mutual-fund runners make – and the unquantifiable perk of working for yourself, and you begin to see why hedge funds, as Van says, "are popping up like mushrooms after a heavy rain."

Broadly speaking, there are a few steps to follow in setting up your fund. The first is to draft its ground rules. If you're a wireless telecom expert and intend to concentrate your investing on start-ups in the industry, say so. Spelling it all out provides legal insulation should the market turn against you. You'll also need to determine the fund's minimum investment, investors' withdrawal rights, and the fees you'll receive. Don't skimp on legal costs – check in with a reputable, experienced hedge-fund lawyer.

Step Two, aka "the tricky part," is to find the money. Personal relationships are the name of the game here. You must approach prospective investors privately; any publicly accessible ad, even on a Web site, could turn your solicitation into a heavily regulated (and probably illegal) public offering. Attorney John Broadhurst of San Francisco's Shartsis, Friese & Ginsburg also advises his clients to set a firm opening date for the fund. "Then there's pressure on people to actually write checks."

Steps Three and Four: Buy low, sell high. — *Charlie Vestner*
Van Hedge: on the Web at www.vanhedge.com/.

Market Timing

Post-it Notes

Is the Net truly equalizing access to market-critical information? Hit your Reload button often enough and the answer seems to be yes. Bloomberg's US\$1,640-per-month terminal still has a wider array of real-time data available than any Web site. But for breaking news, the free CNNfn does at least as well. And at \$12 a month, upstart TheStreet.com is quick out of the blocks with financial news analysis.

How quickly does important news hit the bulletin boards – a sure sign that the word is out and the market has reacted? If the popular Silicon Investor is any indication (see below), rarely more than a few hours. So think fast. — *Steve Bodow*

EVENT

Daimler/ Chrysler merger 5/7/98	India tests nukes 5/11/98	DOJ sues Microsoft 5/18/98	Greenspan holds interest rates 5/19/98
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FIRST POST OF ACTUAL EVENT (EST)

	Bloomberg	TheStreet.com	CNNfn.com	Silicon Investor
2:20 a.m.	9:17 a.m.	12:10 p.m.	2:13 p.m.	
9:11 a.m.	11:30 a.m. (5/13)	12:55 p.m.	2:16 p.m.	
8:40 p.m. (5/6)	8:19 a.m.	11:21 a.m.	2:15 p.m.	
12:43 p.m.	11:08 a.m.	1:35 p.m.	5:25 p.m.	

REACTION

Chrysler up 30%	Mumbai Index off 2%	MSFT down 4% on heavy volume	Dow manages to hold above 9,000
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The Wired Investment Portfolio

In Wintel We Trust

May's market downturn sent many investors into bonds or Dow blue chips. To me, the dip was a signal to do some damage control and to buy big, depressed tech stocks, which historically recover faster than small fry.

Thus I've lost patience with Forte Software's protracted non-turnaround. The WIP is also taking short-term losses in KLA-Tencor and (even though I bought it just a month ago) Sanmina, both of which crashed through crucial support levels in May. I'm also keeping an eye on CellPro; if it loses its pending patent-infringement appeal, it's dead money. I'll quickly put more cash into small caps when they start to show some spark.

For now, I'm putting my faith in the trusts. Competition in sub-US\$1,000 PCs and a delayed next-generation Merced chip have beaten Intel awfully low – too low to resist. And there's a certain Redmond, Washington, firm that's way off its 52-week high of 99 1/8. The Justice Department tango has presented an opportunity to pick up MSFT shares at a sale price.

Excel misadventure: An accounting error associated with my short position in Yahoo! caused us to understate the WIP's cash by \$297,000 in each of the past four months. The fund's overall performance, though, has been accurately reported throughout. — *Jeffery Wardell* (jwardell@hamquist.com)

Company	Primary Business	Symbol	Shares	Close 6/1	Current Value	Δ Since Purchase
HOLDING						
BioChem Pharma	Pharmaceuticals	BCHE	8,000	25 1/16	\$205,504	+21%
CellPro	Biotech medical dev	CPRO	30,000	2 7/16	88,140	-19%
Cisco Systems	Network hw/sw	CSCO	3,000	73 3/16	220,686	+22%
Dura Pharmaceuticals	Pharmaceuticals	DURA	4,000	26 1/32	104,125	+ 9%
Fusion Medical	Medical eqpt	FSON	45,000	3 15/16	177,210	-10%
Intel	Microchips	INTC	2,000	68	136,000	+96%
MMC Networks	Microchips	MMCN	7,500	25 1/8	194,063	+ 6%
Oracle	Database sw	ORCL	5,000	22 1/16	114,060	- 1%
Pfizer	Pharmaceuticals	PFE	1,500	103 3/4	155,813	+ 5%
Remedy	Help desk sw	RMDY	7,500	15 1/16	117,660	-29%
Sprint	Telecom	FON	2,750	71 1/16	197,830	+ 9%
Yahoo! (short)	Internet sw	YHOO	-1,500	104 1/8	156,563	-58%
BUYING						
Microsoft	Software	MSFT	2,000	83 3/4	167,500	
Intel	Microchips	INTC	1,000	68	68,000	
SELLING						
Forte Software	Software	FRTE	15,000	5 1/16	75,930	- 60%
Sanmina	Tech contract mfg	SANM	1,750	74 1/16	130,921	- 20%
KLA-Tencor	Semiconductor eqpt	KLAC	3,500	31 1/4	109,375	- 24%
Cash					\$ 527,093	
Portfolio Value 6/1					\$ 2,317,120	
Portfolio Value 5/1					\$ 2,527,633	
One-Month Portfolio Performance				-8.3%	Russell 2000 Index	-7.0%

Legend: This fund started with US\$1 million on December 1, 1994. We are trading on a monthly basis, so profits and losses will be reflected monthly, with profits reinvested in the fund or in new stocks.

The Wired Investment Portfolio (formerly TWITS) is a model established by *Wired*, not an officially traded portfolio. Jeffery Wardell is a senior vice president executive financial services representative for Hambrecht & Quist LLC and may have a personal interest in stocks listed in the WIP. The opinions expressed herein are those of the author and not necessarily those of H&Q's research department. H&Q has not verified the information contained in this article and does not make any representations to its accuracy and completeness. *Wired* readers who use this information for investment decisions do so at their own risk.

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GET IN THE GAME

Windows 99

◀ 111 to the friable soil of the Florida coast.

Ronald Krueck (pronounced "krick"), 51, teaches at the Illinois Institute of Technology, the Chicago school designed by German Bauhausian expatriate Ludwig Mies van der Rohe. For Krueck and Sexton, one of the most important projects conceived by their idol Mies is surely his Glass Skyscraper, a conceptual design of serpentine lines and transparent walls. Drafted in 1922, the design was unbuildable, given the technology of the day. Even then, Mies believed "the use of glass forces us to new ways." His disciples intend to show precisely how.

Krueck is tall, with thick rimless glasses, a neat salt-and-pepper beard, and flyaway hair flanking a bald spot. Mark Sexton, 42, is trim, voluble, his blue eyes dominating a longish face that nearly vibrates with excitement about the Fish project, a house that is clearly a pinnacle of their 18-year partnership. In a renovation assignment of theirs, a Victorian town house emerged as a cyborg creation, part 19th century, part 21st. The inhabitants of another

pronouncements, including, "We feel sorry for the brick culture," "Glass brings a new era," and, getting right to the heart of the matter, "Without a glass palace, life becomes a burden." Bold words presaged equally bold design, including Bruno Taut's 1914 Glass Pavilion at Cologne, a hall shaped like a crystal artichoke upended on a platform.

Even members of this avant-garde assemblage, however, might have balked at the plans Krueck and Sexton have worked out for the roughly US\$10 million home that will push the limits of current design, structural technology, and common sense. The exterior walls of the oversize, two-story dream house, as well as part of the roof, will be almost entirely glass. And, oh, yes: The building will flaunt its fragile walls on the crumbling shores of a barrier island, smack in the middle of a hurricane zone.

In architectural terms, *folly* describes a structure in which fantastical caprices and bold, eye-catching gestures outweigh utilitarian concerns. Like Antoni Gaudí's Templo Expiatorio de la Sagrada Familia in Barcelona, or English writer Horace Walpole's neo-Gothic castle, Strawberry

an unsolicited letter from a man with the improbable name of Phillip Morris. Morris wrote that he was a paid intermediary for shy and wealthy clients who, in October, had been burned out of their new beachfront home, escaping from the spectacular nighttime blaze with nothing but the clothes on their backs. The Fishes wanted to rebuild on the devastated site and were soliciting proposals from various architects.

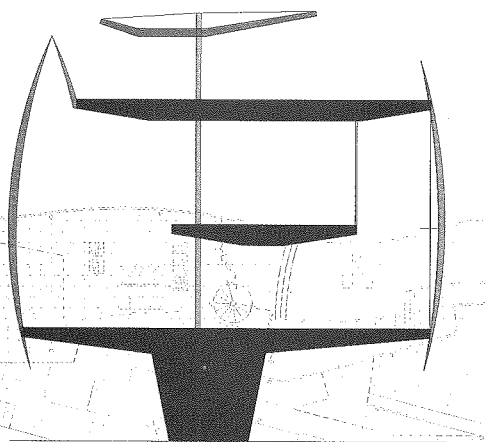
Business had been slow for Krueck and Sexton. "We had almost no projects in '95 and '96 – nothing," Sexton admits. "People seemed to want McDonald's-quality architecture, rather than refined, well-thought-out, and innovative designs. We even tried to market ourselves as 'on budget, on time' architects. We told clients we could do cheap and ugly if that's what they wanted." But then came the letter. Somewhat skeptically, realizing that the missive might be a hoax, Krueck and Sexton submitted their book – a gallery of residential and commercial buildings sheathed in burnished stainless steel, exotic polished granites, speckled terrazo, and, of course, infinite varieties of glass – as a calling card. To their surprise, they won.

Summoned to the Gulf Coast, Krueck and Sexton offered a vibrant impressionistic abstraction in colored graphite and several cardboard-and-plastic conceptual models. The first took an extruded rectangular form. The second introduced jutting corners at either end. The third shattered linearity by breaking the house into two wings set at an angle. A fourth model fused the simplicity of the first with the contortions of the third. A fifth model, still more conceptual than structural, incorporated refinements such as a louvered element along the southern wall to protect the house from the sun without spoiling the view.

In its intricacy, this fifth model conjures a little-known story by H. P. Lovecraft, "In the Walls of Eryx." A human explorer on a habitable Venus, traipsing across a desert, comes upon an utterly invisible barrier composed of a "perfectly transparent, nonrefractive solid." Tracing the wall by touch, he finds a portal. Alas, he enters. Proceeding deeper, past one turning after another, he realizes too late that he's trapped in a sinister labyrinth composed with "uncanny architectural skill." Unable to extricate himself, after several days he dies of thirst within plain sight of freedom.

Whether this design will produce a similarly unhappy outcome depends primarily on 160 ▶

"Without a glass palace," Gropius said, "life becomes a burden." But building one pushes the limits of current design, structural technology, and common sense.



commission, the Stainless Steel Apartment, must surely feel they've wandered into an oversize version of HAL's Lucite intelligence matrix. Most of Krueck and Sexton's spaces, in fact, demand to be filled by leggy, monied spacegirl debutantes in Lurex miniskirts, just back from the Mars-to-Venus Regatta.

With the Fish House, the two partners seem to be the heirs to a movement from architecture's modernist past: Die Glaserne Kette – "The Glass Chain." Early in this century, a utopian cabal, which counted Walter Gropius as its most famous member, issued a series of

Hill, the house Krueck and Sexton are building is a rare form of folly. The architects must be repeating Mies's statement "Whenever technology reaches its real fulfillment, it transcends into architecture" as a mantra as they attempt to lift the house from the vaporish realm of the precise 30-inch by 42-inch schematics tacked to the wall of their conference room.

The story of the Fish assignment involves both mystery and serendipity. One day last December, Krueck and Sexton received

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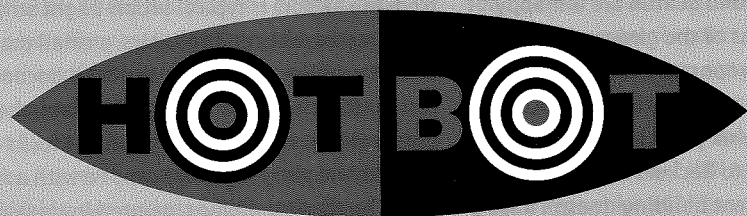
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Windows 99

◀ 158 the engineering. The experts in steel and concrete who will help translate their latest vision into a hurricane-resistant, buildable structure are Roger Reckers and assistant Brian Spencer of Tylk, Gustafson, and Associates. Spencer totes a top-of-the-line laptop on which he can model loads and performances using RISA, a powerful software program for 3-D simulation. Like the other engineers and construction men involved in this project, Reckers and Spencer exhibit a kind of hard-nosed playfulness – a respect for the ineluctable powers and limits of nature combined with a desire to push the envelope and a faint amusement that anyone would actually attempt such a stunt.

Spencer massages data on the fly, while Reckers outlines the possibilities. Piles will be driven into the sandy soil. Atop these underground supports, triangular concrete piers 10 feet high will rise to a concrete bed. Think of this platform as a cake plate supporting the confection of the house itself. Steel girders will project upward and outward from the plate.

*"If this were my house," says a construction consultant,
"I'd be living in a tent on the beach with
my money invested in the stock market."*

Narrow curved steel splines will be pinned to the girders at top and bottom – ideally, every 10 feet – forming a nearly invisible coupled support system for the outer glass walls.

The architects had hoped to clad the torso of the house with panes 10 feet across and 2 feet, 3 inches high, keeping the number of intrusive splines to a minimum. The long narrow sheets of glass, pinned together, angled slightly edge to edge, and sealed with an invisible silicone gel, would give the outer walls their smooth continuous curve. But the manufacturer insists that the support system the architects have planned isn't adequate; such large sheets of glass will need girders or cables every five feet. In one stroke, the number of vertical reinforcements has doubled, sending ripples throughout the design.

Although glass is clearly perverse at times – it is often fragile and heavy and settles with age – Sexton still describes it as "one of the most flexible materials known to man." The material is relatively inexpensive, it is beautiful,

and it can be surprisingly tough. Theoretically, the finished Fish House will withstand 150-mph winds, deflecting only three-quarters of an inch from the vertical.

Though the finished house may be immune to the elements, the house-in-progress is not. Many times each year, the site is subjected to winds of 40 mph or more that can whip a sheet of plywood right out of a laborer's hands. Luckily, the segmented design of the walls will make it easy to replace single cracked panes. But if a big hurricane hits in mid-construction, Sexton admits, "the house is gone."

None of the materials, not even the cement, can be off-the-shelf. The steel – which will be shaped and cut with computer-controlled plasma torches – can only be handled by a few boutique mills. The shops the partners will use are all up north, necessitating long distance shipment. The surface finish of the steel, as well as of the cement, is critical. In a Krueck and Sexton dwelling, components normally hidden in conventional homes remain exposed. "These girders become your living-room walls," Krueck notes. The primary ingredient will be

provided by one of the oldest glass manufacturers in the world, Pilkington Glass in Saint Helens, England. One of the company's newer secrets is an advanced glazing technique that delivers unprecedented transparency.

Of course, even ordering the construction materials is still months away. The most immediate challenge is to design a structurally sound but visually elegant steel spine. It's early spring, and Krueck and Sexton are unhappy with the dimensions of the girders the engineering team has proposed. The partners envision the bulky columns chewing up precious interior space. "I think you need a new computer," Krueck says to Reckers and Spencer. "A 20-story apartment building doesn't have a column that big. I'm a little flipped out." Reckers shrugs. After hours of wrangling, the engineers are sent off to refine their estimates. The battle lines are drawn in a contest between dream and reality, magic versus mass.

As if for comic relief, an afternoon meeting is devoted to MEP: mechanical, electrical, and

plumbing concerns. David Lehman of LDC Consultants arrives hefting a bag of macaroons – a peace offering – and a handful of his own engineering problems. As the three men munch, Lehman reports on possible heating, ventilation, and air-conditioning (HVAC) systems. The builders put power-plant choices aside to concentrate on how to deliver the quantity of processed air necessitated by the local climate, which ranges from freezing to tropical. With few interior walls, the house has insufficient space to hide all the ugly but necessary pipes and ducts. Without adequate ventilation systems, the glass house will suffer the same problems as Mies's glassy Farnsworth House in Illinois, which was a cooker in summer and a condensation-dripping chiller in winter.

If they surmount this dilemma, the architects are still left with Mr. Fish's firm intention to open the windows in good weather. Such old-fashioned whims play havoc with any respectable cybernetic HVAC system, in which sensors automatically compensate for "unnatural" fluctuations. Lehman wants the residence hermetically sealed – no stray inputs or outputs to disturb the balance of the system. The architects wince, knowing this option will be unacceptable to their clients.

Faced with a bewildering variety of delivery systems, Krueck finally demands, "Which one would you pick if this were your house and your money?"

"If this were my house? I'd be living in a tent on the beach with my money invested in the stock market," Lehman quips.

Along the Florida Panhandle's coastline, referred to by some the Redneck Riviera, new condos are going up on beachfront real estate everywhere. The avenue leading south from the airport is typical urban-blight strip: chain restaurants and retailers, a small mall. But a few miles farther on, the road becomes residential, passing a variety of houses, the predominant style featuring cinder blocks stacked one story high and capped with a flat roof. The squat buildings, painted in clashing Caribbean colors, undoubtedly stand up well to storms, but they're as ugly as toads.

You push on, over the 3-mile-long bridge from the mainland and onto the peninsula, and turn beachward at the sign, circa 1963, of a leaping swordfish. Then, after crossing a shorter bridge to the barrier island, you come

upon a mushroom-style water tower painted to resemble a striped beach ball. The main drag meanders past souvenir stands and Flounder's restaurant, where the men's rest room is stocked with hair spray for frat boys, and elderly roués enjoy the Drink Special – triple-shot martinis in glasses the size of bed-pans. The road continues past a few garish and shoddily constructed Narco Deco mansions and some beach bum's idea of a groovy bachelorette pad: a corroded white metal ovoid with porthole windows, resembling something out of a 1967 *Playboy* feature on the Swinging Lifestyle. (At this juncture, the imperious architects snort derisively.) Up comes a large dune formation known as the Sugar Bowl, and then, nearby, the Fish House site.

The fire that claimed the Fishes's old house was visible from the mainland, and made the national news. It left a partially drained swimming pool, spalled concrete platforms, cracked outdoor tiles, scorched loblolly pines around the perimeter, and stainless steel melted into surreal forms. (The deck railing dripped away when it hit 1,500 degrees Fahrenheit.) Kicking around the charred property, Krueck and Sexton enthusiastically pace off rooms and speculate about how they will incorporate the remains of the pool into their design. They're deep into the never-ending refinement process, which Sexton compares to composing a symphony.

"We look at the drawings and models and realize that certain elements are unbalanced, some things look ugly, a few issues are not resolved," he says. "So we go over the whole composition: 'Here, the horns are too loud. Let's soften them and bring in the violins.'" Krueck and Sexton already know that the northern face of the house will flirt with the soft curve of the waterline 20 yards distant. The white stone panels of the southern side – an allusion to the white sands of the dunes – will also offer protection from the sun, as will swatches of fritted glass, panes with ceramic dots baked in a sieve pattern that cuts sunlight by up to 80 percent. Other engineering issues, however, remain stubbornly intractable.

Nothing can mitigate the proximity of tide and gale. It is staggering to see how close the water actually is, how perilous the physical situation appears, how outrageous the design suddenly seems. Even on a calm, sunny day it's easy to picture galloping, wind-driven waves lashing the glass sheath with the ferocity of any firestorm. Although Krueck and Sexton

don't speak of the peril explicitly as they stand surveying the water, hours later Krueck says pointedly, "A house like this is meant to be experienced over a long period of time. We're not building it for the moment, we're building it for the future."

Another structure built for the future stands several miles from the Fish site. On the other side of the island is a federal park, entered via a near-virgin stretch of dunes and scrubland rich with birdsong. At one point the island narrows to less than a hundred flat yards: The contending lines of surf seem ready to leap the gap and devour the land. On this tip of the island sits the ruins of Fort Pickens. In 1829 the US government began to construct this guardian of the bay, bringing in a massive slave force to toil or die of yellow fever. Millions of bricks came from New Orleans and Mobile, lime was shipped from Maine, lead was hauled from Illinois, and copper and granite were sent from New York. Construction lasted five years. The result was a massive pentagonal fortification enclosing a five-acre parade ground.

Today, visitors can still see the clever system that collected rainwater to feed cisterns, and the structural coup, the "reverse arch," a buried cement structure that helps distribute the downward forces of the formidable pile across the sandy soil. The once-massive structure of Fort Pickens is a lime-dripping, barrel-vaulted ruin, abandoned but still impressive, strong but not immortal.

If the decaying garrison embodied the values of 19th-century construction – strength, mass, and permanence – Krueck and Sexton are striving for its antithesis. Their designs for the Fish House seem to transcend the physical, to achieve lightness and beauty through the ephemeral elegance of glass. Where Fort Pickens established its military presence with solid belligerence, the Fish House aspires to escape its corporeal chains, to make itself disappear. But when even structures built to last crumble, how will Krueck and Sexton's floating glass house stand up to the elements – the wind, fire, and water? Will technology finally fulfill the promise of Mies van der Rohe?

Dozens of contractors and subcontractors will spend more than a year constructing the house, a futuristic folly, a beached quartz whale. At the least – assuming construction begins on schedule in January 1999 – the Fish House will ring in the new millennium, a crystal bauble dangled in the faces of the gods. ■ ■ ■

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Die, Robot

◀ 118 built several robots myself, but I would not enter this contest, because I don't think robots should be destroying each other."

Others, however, revel in the aesthetics of destruction. Peter Abrahamson, who by day freelances creating animatronics and puppets for Jim Henson's Creature Shop, spent eight hours a day for four months building his robot for the 1997 event. "But even if it gets shit-hammered," he commented beforehand, "and hydraulic fluid is all over the place, and a battery catches fire – it's totally OK. I'd love that, going down in a big blaze of glory."

There's something more visceral here than the intellectualized "celebration of archetypes" that Marc Thorpe propounds. Robot Wars has the same primitive appeal as any schlock sci-fi movie in which spaceships are vaporized or cities are reduced to rubble. But that's the least of it. In a world of sleek, boringly efficient gadgets that are becoming increasingly soph-

isticated and intimidating, it's fun to watch retro robots that are designed to destroy – or be destroyed. In fact, their fallibility gives them a sense of innocence and even charm, like not-very-smart children.

year vendetta now promises to reach an especially devastating climax at this year's event. Robot Number One in this feud between the ugly, the bad, and the good is Blendo, a metal dome like a giant hubcap, concealing a gasoline-powered lawn-mower motor that turns a 120-pound flywheel. Two blunt steel blades protrude at the rim, reaching a rotational speed of 70 miles per hour when the flywheel attains its cruising speed of 400 rpm. In test sessions, Blendo has destroyed surplus office furniture with ruthless efficiency.

The machine's builder, Jamie Hyneman, wears a black beret and camo fatigues and stands with military posture, like a Special Forces veteran promoting his favorite land mine. "In 1995," he says, barking out the words, "the first opponent we went up against was a quarter-inch-plate steel barrel. He just sat there and died. The second guy had spikes all around him, and we ate them like corn on the cob. The way I see it, the more destruction we can cause, the better."

Hyneman shows no hint of concern, because at Robot Wars, destruction is the whole idea. "In a boxing ring," he says, "if you knocked the other guy down and continued to beat him to death, that would be bad sportsmanship. But at Robot Wars, you're expected to do this."

Blendo's unashamedly ugly, like a sullen kid with pimples who beats

up other kids because they're nicer looking or get better grades. "It's low tech," Hyneman agrees. "But we're proud of that. We invested less money and effort than anyone in our weight class, and we made a more dangerous robot. I think that means we're smarter."

In fact Blendo was so dangerous, he was evicted from the 1995 Robot Wars when shrapnel torn from one of his opponents landed in the audience. Hyneman didn't attend the 1996 event, but Marc Thorpe felt compelled to strengthen the arena so that the deadly spinning dome could be invited back for 1997.

Alas, despite the modifications, history repeated itself. When Blendo faced his first opponent, a hapless aluminum box named Hercules, he ripped off a piece of armor and

threw it across the arena, carving a two-inch gash in the bulletproof glass. If the trajectory had been a few feet higher, the jagged-edged metal would have hurtled into the crowd with potentially nightmarish consequences.

Once again, safety officials banished Blendo. This roused a collective sigh of relief among most other participants – but not all. Greg Munson and Trey Roski were seriously pissed about it, having spent the entire previous year actively planning a showdown with the seemingly invincible monster bot.

Munson, 32, is lean and manic, with an intent look in his eye. Roski, his cousin, is a year older, less talkative, but equally obsessed. By day they run a digital design business in San Francisco, but robots are their all-consuming passion. "When we were kids," says Roski, "Greg and I always messed around with radio-controlled cars, helicopters, and model rockets. And we always blew up our toys at the end."

Munson nods. "That's common among robot people."

"It feels better to blow it up yourself than have it break," Roski explains.

Munson does most of the engineering work, while Roski, a former helicopter pilot, deals with the driving – and the destruction. "In 1996," he recalls, "when I hit the South Bay Mauler, it was launched about five feet in the air, three feet backward, and fell on itself." He smiles happily at the memory. "Nothing compares with being in total control of a robot, facing another guy's robot, and destroying it. I don't know what it's like to be a rock star, but – competing in Robot Wars has to feel something like when Pete Townshend smashes his guitar. A total adrenaline rush."

What if his robot is the one to be demolished? "We don't have Builder Syndrome," he says dismissively.

"That's when people get so involved with the thing they build, they can't bear to see it broken," Munson explains.

"Yeah, we don't care," says Roski. "On the night before Robot Wars, we take all the remote-controlled cars and airplanes that we've made during the past year and smash them up, to get rid of Builder Syndrome."

They entered Robot Wars originally in 1995 as ballsy upstart amateurs with a cheap \$600 middleweight named La Machine. Her simple wedge design won no awards for good looks but was so effective at knocking adversaries out of the ring, she won not only in her own



"Robot Wars offers a license to celebrate archetypal elements of life and death," says founder Marc Thorpe. In five years, the "art event" has developed a much more primitive, and popular, appeal.

isticated and intimidating, it's fun to watch retro robots that are designed to destroy – or be destroyed. In fact, their fallibility gives them a sense of innocence and even charm, like not-very-smart children.

"You would think that a bunch of machines bashing each other would be utterly devoid of emotion," comments John Knoll, who developed the first version of Photoshop, Adobe's legendary graphic arts application. "But when you're there, you are keenly aware of the very human personalities." Knoll, an ILM visual effects supervisor, is working on the new *Star Wars*, but he always takes time out to build something for Robot Wars.

The robot personalities create intense drama in the heavyweight division, where a three-

category, but in the heavyweight *mêlée* as well. In 1996 La Machine was victorious again, but Munson and Roski weren't satisfied. Jamie Hyneman gave an interview stating if he hadn't been disqualified, Blendo would have pulverized La Machine. For Munson and Roski, this was intolerable. It became a matter of honor to confront Hyneman's robot and affirm their legitimate status as champions.

In collaboration with another self-taught model maker, Scott LaValley, they raised \$25,000 from corporate sponsors and embarked on a massive R&D effort. At LaValley's parents' home in northern Marin County, where neighbors still keep horses in their front yards, the robot builders spent long weekends in a garage cluttered with disassembled motors, metal sheeting, welding equipment, and massive cabinets full of tools. Adjacent to the garage they set up a work area equipped with a band saw, drill press, air compressor, and 7-foot-high industrial-grade milling machine donated by another corporate sponsor, Jet Machine Tools.

From this crucible was cast a new version of La Machine, specifically designed to annihilate Blendo in the 1997 contest. Barely under the 180-pound maximum weight limit, the wedge-shaped shell of quarter-inch welded aluminum plate supposedly would withstand a hammer blow from the spinning dome, slowing it enough for La Machine to execute her classic ramming action, leaving Blendo spinning helplessly on his head.

The one thing they didn't count on was Hyneman getting disqualified again, removing his robot from the contest and leaving La Machine facing a very different adversary: BioHazard, the third player in the three-way vendetta.

Built by Carlo Bertocchini, who does mechanical design for a company in Menlo Park, BioHazard is a gleaming flat slab of stainless steel, titanium, magnesium, and aluminum just 4.5 inches high, edged with hinged fender skirts that brush the floor. Underneath the armor, wheels, motors, batteries, and wires fit together with exquisite precision, like something fabricated by NASA. Technically and artistically, BioHazard is a thing of beauty.

Designed primarily to be invulnerable to attack, BioHazard has only one offensive tool: a jointed arm terminating in a shovel blade which slides under other robots and tips them over.

Bertocchini dresses immaculately in a clean white shirt (unlike almost any other Robot Wars

participant) and comes across more like a classical musician than an engineer. He speaks softly, showing gentle affection for his creation. "BioHazard in 1996 was disabled when I got a good sideswipe that bent the arm," he says, sounding sad. "But in 1997 I made it a lot stronger. Formerly, this lever was made out of magnesium; now it's titanium. I went from four-wheel drive to six-wheel drive, and added the fender skirts. There's not much they can damage. Even the motors have hardened cases."

Sure enough, in 1997 BioHazard was imperious to all comers – including La Machine. Immediately before their confrontation, Roski and Bertocchini stood side by side, elbow to elbow, oblivious to each other as they held their radio-control units, ready to duel vicariously via their metal children in the arena. As soon as the match began, Roski thought he saw an opening – but suddenly found his robot pinned against the wall. BioHazard's articulated arm slid out, the shovel blade slipped insolently under La Machine's metal skirt, and within 15 seconds Bertocchini trivialized a year of R&D and thousands of dollars in corporate sponsorship. La Machine was flipped onto her

over. They installed a giant suction cup that would clamp itself to the floor, resisting as much as 1,000 pounds of upward force. They abandoned this concept, though, because it immobilized their own robot as well as the opponent. "We've figured out a much better solution," Munson now claims. "I can't say exactly what we have in mind, but if we get tipped over this year, we won't stay tipped over. That's for sure."

They've also installed a hinged steel flap that folds down flat in front of their robot, low enough and thin enough to slide under BioHazard's fenders – or under the dreaded Blendo, whom they *still* hope to confront. They're so confident, in fact, that they already challenged Hyneman to a private duel in a parking lot. (He declined.) Still, in August it seems they will have their chance for the ultimate showdown. Marc Thorpe now claims that absolutely, positively the arena will be made tough enough to withstand any carnage that Blendo can inflict. "I swear I'll never let the situation happen again," he says, "where a robot conforms with the rules but has to be asked to withdraw."

BioHazard beat all comers in '97 – including La Machine. But she's had a top-to-bottom makeover. And Blendo's back.

side, stranded ignominiously at the edge of the arena, while Roski stared in disbelief.

A couple minutes later, back in The Pit, a British TV crew asked Munson if he was disappointed. "A little," he said, looking shattered.

The interviewer turned to Roski. "How do you feel?"

He stared back at her. There was a long silence. "I don't know," he said finally.

In truth, it was an intolerable blow. Still, the former champions were unbowed. On the very night of their defeat, they started plotting their comeback. A couple days later, their usual in-your-face attitude reasserted itself, and they started sounding like Don King. "In 1998 we're going to turn BioHazard into an art piece," boasted Munson. "The only thing Carlo will be able to do with it, after we've finished with it, is hang it on the wall."

They experimented with various methods to prevent La Machine from being tipped

Typically, Thorpe delivers this vow with absolute conviction and heartfelt sincerity. He may still be stymied, though, by the inherently unpredictable nature of Robot Wars. This spectator sport is technology-driven, and the technology is still very young. Human ingenuity has already yielded some bizarre, baroque, mind-boggling combatants in the arena of mechanized destruction, but, without a doubt, the ultimate potential in this arcane art form is still waiting to be discovered.

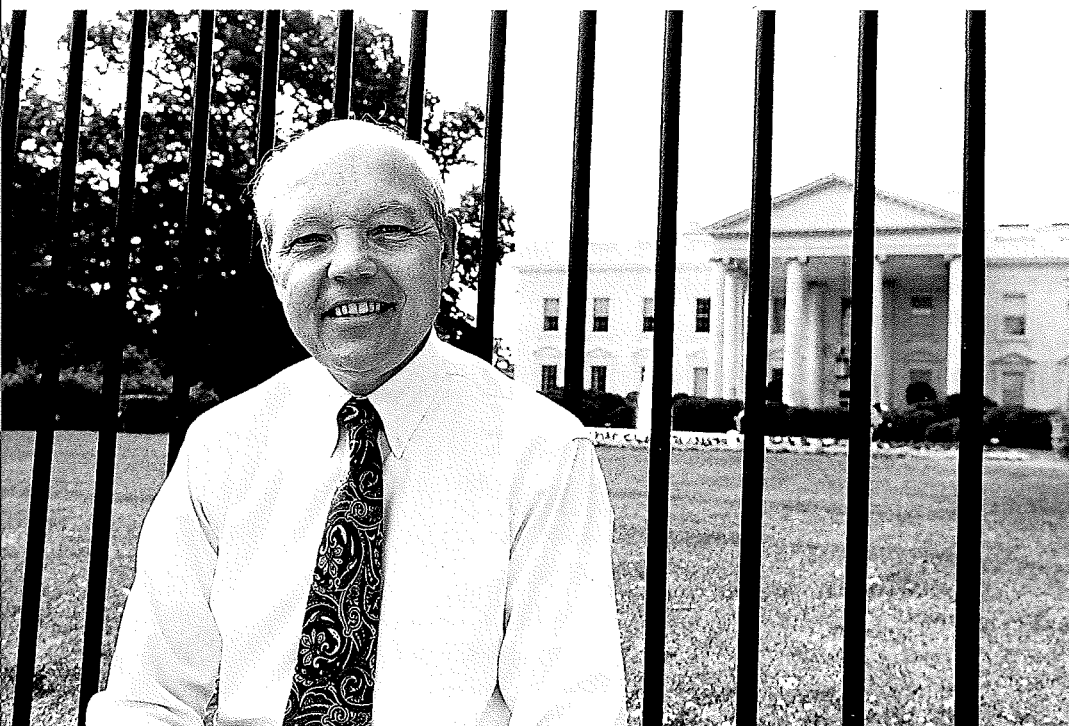
At this very moment, an unknown, an outsider, could be toiling in a garage workshop, perfecting a new robot that complies with all the regulations yet is even more lethal than Blendo – in which case Thorpe will face a new dilemma. And, more important, the feuding triad of veteran contenders might find themselves humiliated in a surprise upset perpetrated by a – gasp – rank amateur.

Don't miss it. ■ ■ ■

Y2K: Run For Your Life!!

◀ 125 year, he was a happy-go-lucky Y2K project analysis manager for DMR Consulting, a Canada-based computer consulting firm, just finishing up a big remediation project for a major American phone company. The effort was grueling – 10 writers, programmers, and analysts cleaning up 10 million of lines of Cobol code. But in the end it all worked out, and the phone company's billing system was declared ready for 2000.

In that heady moment of self-congratulation, Bill Finch, one of Steve's coworkers, approached him with a thought. "Steve," he said, "don't you realize that everything stops if the power grid goes down?"



Zero zero czar: John Koskinen, head of Clinton's Year 2000 Conversion Council, avoids using the word "crisis," but keeps a digital desktop clock that's counting down to 00.

Anxiety set in. The telephone company had poured substantial resources into its Y2K effort. Even then, Steve's project had been an odyssey plagued with countless unexpected glitches and snags. If the power utilities – with their Byzantine grid of thousands of generators and substations around the continent – weren't already well along in their efforts, then all the systems he'd dragged into Y2K compliance would be dead as doornails when the lights went out.

That afternoon, Steve hit the Net, where he learned that the situation is far worse than he

had imagined. The power grid relies on a sophisticated feedback mechanism: Remote terminal units report their power needs up the communications chain that controls the output of electricity generators. The entire network is riddled with embedded chips. Nuclear plants supply nearly 20 percent of the power in the grid, and none of them have been certified as Y2K compliant. Charles Siebenthal, head of the Year 2000 embedded systems project at the Electric Power Research Institute, says the industry is just beginning to look for potential Y2K failure points. Anecdotes from industry consultants suggest that if the year 2000 came today, every utility in the country would crash. "No electric plant or facility of any kind has been

Y2K tested without some kind of impact," says David Hall, a senior consultant with the Cara Corporation. "There isn't enough time to fix everything. There will be some disruption. How long? How deep? We just don't know."

Then there are ripple effects to consider. "There's not a single railroad switch in the country that's manual anymore," Steve says. "They're all computer controlled, and railroads deliver coal and fuel to power plants."

Exit Steve Watson, bright-eyed optimist; enter the new Steve Watson, Y2K survivalist, rugged pioneer, and Renaissance man in

training. Steve began spending six hours a day on the Internet, studying alternative power, construction techniques, and emergency medical procedures. Anything he couldn't find online, he ordered from local bookstores or Amazon.com. He'd never kept a gun in the house, but soon he had three: a 30-30 for deer hunting, a .22 for small game, and a 9-mm handgun for personal protection. Of course, the 9-mm is practically a popgun against looting mobs, so four M-16 assault rifles are also on the way.

Finally, he pooled his money with Bill Finch, his DMR coworker, to buy 500 remote acres in Oklahoma. (Bill holds the public deed to the property, so his name has been changed in this article to keep the location secret.) In choosing the hideaway site and its size, Steve overengineered to account for family and friends – few of whom subscribe to his Y2K scenario. "Most people think I'm nuts. Even my kids think, Dad's going off the deep end." Steve's wife, Teresa, has been more supportive. She's no computer expert, but her Baptist faith tells her that the Four Horsemen of the Apocalypse could ride in with a global computer crash. Meanwhile, Steve is making plans for everyone else: close friends, family members, sisters-in-law, brothers-in-law – and their children, mothers, and fathers. Forty people in all. In 2000, they'll work together to till the soil and patrol the fence line.

Steve's doomsday vision is the same as that of most Y2K radicals, but radicals can pop up in some pretty mainstream places – like the US Central Intelligence Agency, which is advising its agents abroad to keep cash on hand and stockpile extra blankets in preparation for New Year's Day 2000. The agency worries that bugs in the power networks and communications backbones of developing nations could cause outages that would jeopardize the safety and well-being of its agents.

Millions of Americans have already gotten a small taste of critical system failure. When the onboard control system of the Galaxy IV communications satellite failed on Tuesday, May 19, 1998, the outage temporarily crippled US pager networks, several broadcast news operations, and even credit card verifications systems. Most of the disruptions were brief – technicians were able to switch to backup communications paths – but doctors who use pagers as a lifeline with patients and colleagues were forced to set up camp in 165 ►

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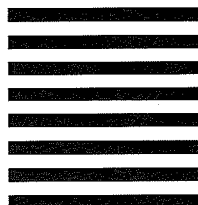
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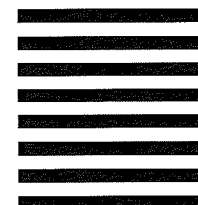
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America Offline

(Inside the Great Blackout of '00)

"Most of the nation's power systems must be compliant, or they all go down, region by region, in one gigantic, rolling blackout," warns Gary North, keeper of the oldest, most notorious Y2K doomsday site on the Web. If the lights go out at the dawn of the 21st century, North believes the failure will be permanent, because the computers that control the grid will be unfixable if there isn't power to run them. Thereafter, he argues, the blackout will trigger the collapse of civilization.

The North American grid is vulnerable to simultaneous failures. Generating facilities in the US, Canada, and Mexico jointly move power through high-tension lines that distribute electricity through four regional interconnectors. Within each region, if one facility goes offline, the others compensate to pick up the slack. But there's not much spare capacity built into the system; the North American Electric Reliability Council, a group that is drawing up a timetable of Y2K fixes for the Department of Energy, admits that if multiple generating facilities fail in one region, this "may result in stressing the electric system to the point of a cascading outage over a large area."

This is how it could happen: A power station is equipped with safety systems that deactivate steam boilers if they aren't maintained frequently. Suppose maintenance was last performed in 1999, which an embedded chip recorded as "99." Now it's the year 2000, so the chip subtracts the old year, 99, from the new year, 00, and finds, amazingly, that maintenance was last performed 99 years ago. Clearly this is an error, so the chip shuts down all the boilers, just to be safe.

Meanwhile, at another power station, a temperature sensor attached to a transformer averages its readings over time. On January 1, 2000, the sensor divides temperature by the year – which is expressed as "00" – and comes up with an infinite value, triggering another shutdown signal. If small faults like these knock out a half dozen facilities, the rest will go offline to protect generators from

burning out in a hopeless effort to meet the growing demand.

The distribution grid also has weak points. "We have at least 800 different types of embedded controls on the wires," explains Gary Steeves, director of a Y2K project at TransAlta Utilities, the largest investor-owned power company in Canada. "Some of the protective devices log dates of faults in activity and can automatically take a component out of service." If the same controller has been installed in thousands of remote locations, and the chips share the same Y2K bug, they'll all fail simultaneously.

Additional Information

.....
Gary North's apocalyptic warnings
www.garynorth.com/

Rick Cowles's electric utilities info page
www.euy2k.com/

North American Electric Reliability Council
www.nerc.com/y2k/

Y2k News:
www.y2knews.com/

Most US power utilities refuse to comment on the likelihood of these disasters, fearing litigation if they offer reassurances that turn out to be wrong.

Tim Wilson, publisher of *Y2k News*, worries about the nearly 9,000 small regional companies that pull power off the grid at the local level. "They're clueless as to what to do about Y2K," says Wilson. "They know they have embedded chips, but they don't know where they are. If there's a power shortage, rural areas may not be allowed to take power off the grid, because cities could have a higher priority."

This suggests an ironic scenario: Remote areas may remain dark for weeks or months after January 1, 2000, leaving Y2K survivalists waiting in their isolated cabins for the lights to come back on – while complacent urban dwellers enjoy uninterrupted service. – Charles Platt

◀ 164 hospitals and offices. The failure of one satellite threw a wrench into the mechanisms of modern life, perhaps providing a peek at what life may be like at the dawn of the new millennium.

Or sooner. While the full brunt of the Y2K bug is reserved for AD 2000, some early problems are already developing. In 1996, Visa and MasterCard temporarily stopped issuing credit cards with an expiration date of 2000 after credit card verification terminals began choking on the "00." The gaffe led to customer complaints and a lawsuit filed by a suburban Detroit grocery store against its computer supplier, TEC America Inc. Since then, most verification systems have been upgraded, but Y2K is making its presence known in other areas. The Information Technology Association of America released a survey last March showing 44 percent of the US companies they polled have already experienced Y2K failures. Ninety-four percent of the respondents termed Y2K a "crisis."

The GartnerGroup estimates that 180 billion lines of code need to be examined and that 20 to 30 percent of all firms worldwide have not yet started preparing for Y2K. Many of these are expected to suffer significant failures. In a series of studies issued over the last year, Gartner surveyed 15,000 companies in 87 countries to assess their Y2K readiness. The results weren't encouraging. Small companies rated lowest – for most, winning over new customers has taken priority over the Y2K problem. But midsize and large companies are lagging, too. Gartner then rated the overall Y2K efforts of industrialized nations on a scale of zero to five, where five is total compliance on all systems. The highest scorers on the scale, including the US, Canada, and Australia, rated somewhere between two and three – a score that suggests they have completed an inventory of Y2K vulnerabilities, but not yet developed a comprehensive remediation plan.

The US may be at the front of the pack in the Y2K race, but that's small comfort to some legislators. Last March, the House Subcommittee on Government Management, Information, and Technology warned that 37 percent of the critical systems used by federal agencies will not be ready in time. Then in June, California Republican 166 ▶

Y2K: Run For Your Life!!

◀ 165 Stephen Horn, who heads the subcommittee, issued a scathing report card on the Clinton administration's Y2K progress. He gave the government an F.

John Koskinen, head of the president's Year 2000 Conversion Council, complains that Horn is just a tough grader. "As a government, we're in a C+ to B range," he argues. Koskinen keeps a digital desktop clock that runs backward – on the day we spoke, the clock showed 609 days, 8 hours, 39 minutes, 16 seconds, and counting – but he generally refrains from calling the situation a crisis. Instead, he describes it as a "critical management challenge."

"There's not enough information right now to indicate that stocking up on Coleman stoves and Sterno is an appropriate response," he says. And in the end, he predicts, "a lot of people won't notice."

Koskinen has earned the respect of some Y2Kers by emphasizing the need for high-level planning in the event that some systems fail. But Y2K survivalists feel more comfortable with their own personal contingency plans, and a commercial infrastructure is already forming to support them. Walton Feed, an Idaho food distributor that sells products over the Net, is doing a brisk business in long-term supplies; the company attributes this to Y2K. And in Sully

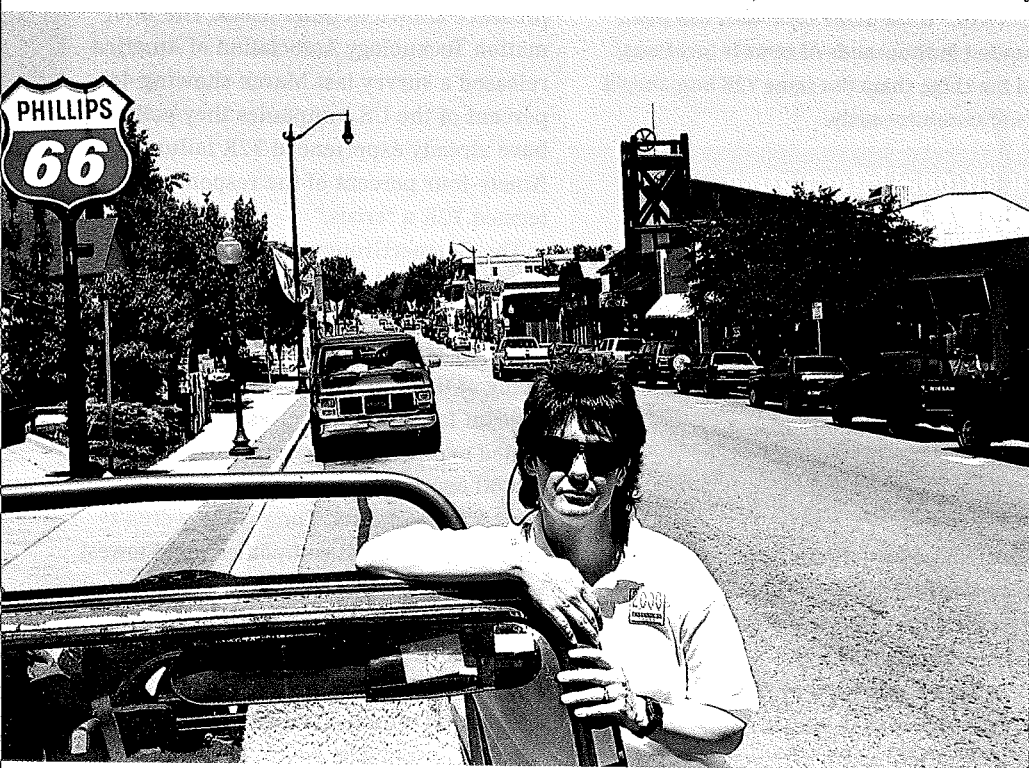
just a Boy Scout fetish, and it isn't always about getting away from it all.

"If everybody moves to rural areas, they'll just take their problems with them," explains Paloma O'Riley, a red-haired, forty-something mother, wife, and computer expert. Paloma lives in the small town of Louisville, Colorado, just east of Boulder, and when she looks around her community she doesn't see potential looters – she sees neighbors. Her suburban hamlet has become a major landmark on the Y2K map as the world headquarters of The Cassandra Project, a grassroots Y2K preparedness organization that can perhaps best be described as a kind of Millennial Neighborhood Watch.

Until last year, Paloma was a Y2K project manager at the Rover Group, a UK-based auto manufacturer, where her first responsibility was to identify all of the company's vulnerable systems and target them for patching. But her search didn't end with a couple of corporate mainframes. Inadvertently, Paloma opened up the Pandora's Box of Y2K: embedded systems.

Embedded systems draw the Y2K bug-fixing task out of cyberspace and into the real world. There are lots of pea-brained microchips out there, nestled in everything from microwave ovens and automobiles, to power plants and oil refineries. Most don't care what the date is, but a small percentage of them do, and that made Paloma nervous. "I became concerned about just how prevalent embedded systems are," she recalls. "Several members of my family have medical problems, so when I started investigating I became very concerned about medical devices like defibrillators, physiological monitoring equipment, and the entire medical services infrastructure."

When her contract came up for renewal in 1997, Rover asked Paloma to stay on in London to 2000. She declined – the thought of family and friends surrounded by non-compliant systems that might leave them cold, hungry, and without medical services was too much to ignore. Back in the States she began networking with other people who shared her concerns, and that's when she realized "we needed to put together an organization to address the issues and get information out to the public."



Staying power: To spread the word among family and friends, Paloma O'Riley founded The Cassandra Project – a millennial Neighborhood Watch in suburban Colorado.

He fully expects the federal government's critical systems to be ready on time, or even early. "Many companies, financial institutions, and federal agencies are still working on the problem," he says. "But most major organizations plan to have their solutions in place by the first quarter of next year."

If the council is successful, Koskinen believes, Americans will confront little more than a few minor inconveniences when the year 2000 finally rolls around.

County, South Dakota, developer Russ Voorhees has attracted national publicity and hundreds of potential clients for his "Heritage Farms 2000" project – a Y2K survival community that's been on hold since June, when a local planning commission refused to grant the necessary building permits. For those who want to go it alone, there's a sense of adventurous fun in their preparations – the pride of self-sufficiency and an excuse to get away from the keyboard to earn some merit badges. But Y2K preparedness is not

Thus The Cassandra Project was born. In Greek mythology, Cassandra was a mortal woman courted by the god Apollo. To win her affections, Apollo gave her the gift of prophecy. Still, Cassandra rejected him, so the frustrated deity decreed that no one would ever believe her predictions. Paloma O'Riley gave a nod to Cassandra's fate when she chose the name for her Y2K preparedness group, but she is precisely the kind of mortal woman you'd want at your next PTA meeting – a firm believer in the notion that some good, old-fashioned community-building may keep the Y2K nightmare at bay.

The Cassandra Project has helped spawn a dozen Y2K community preparedness groups around the country. It has a board of directors that includes several computer professionals and a Web site at *millennia-bcs.com* that lists a menu of articles discussing possible Y2K scenarios, ranging from minor annoyances to outright Y2Kaos. The site attracts more than 100,000 visitors a month.

Between speaking engagements, Paloma spends her days organizing biweekly meetings with neighbors to discuss contingency plans, and lobbying the state government. "We've been working with the Cassandra group on a lot of their initiatives," says Steve McNally, staff director of the Colorado Information Management Commission. "They've talked to several legislators and the governor's office and brought some awareness of the issues to the table."

For her part, Paloma and her family plan to stockpile a six-month supply of food. Her worst-case scenarios look much the same as those of the most hardcore, self-sufficient Y2K survivalists, but the bomb-shelter aspect is conspicuously missing. Paloma believes that people will pull together in times of turmoil. If calamity strikes and she is forced to draw the line, she's determined to do so in her own backyard.

Even if Paloma's neighborly pragmatism sets her apart from the militia types and fundamentalist Christians who regularly contact The Cassandra Project, her efforts have brought her in contact with a thriving premillennial subculture. "People in other millennial movements, including Christian fundamentalism, point to Y2K as a sign of the times," says Philip Lamy, a professor

of sociology and anthropology at Castleton College in Vermont. Lamy specializes in the study of secular millennialism, and he sees Y2K survivalism as a prime example of the genre. "Generally, millennial movements appear when a society or culture is going through a period of rapid cultural, economic, or technological change," he says. "The explosion of the Internet and the World Wide Web is fueling a lot of this now."

Still, there are a few things that set the Y2Kers apart from the crowd. For one, the Y2K bug is not simply a matter of myth, superstition, or prophesy – it is a tangible problem hardwired into the fabric of our industrial society. In addition, the people who are taking Y2K most seriously are not laypeople or neophytes – they are specialized technicians who approach the situation with a sophisticated understanding of society's hidden machinery. But if heightened technical awareness alone could explain the apocalyptic conclusions drawn by the Y2K survivalists, then every well-informed computer geek would be moving to the desert – and that clearly isn't happening. With so many intertwined variables to consider, logic inevitably takes a back seat to subjective intuition – a personal sense of security that extends from the microcosm of a single computer program to the macrocosm of modern society. Ultimately it all comes down to faith.

But this, too, sets the Y2K survivalists apart. True millennialism is rooted in faith – fundamentalist Christians may anticipate an apocalypse, but they optimistically expect it to be followed by 1,000 years of celestial rule. Y2K survivalism, on the other hand, doesn't concern itself with redemption. It is antimillennial – the polar opposite of techno-millennial movements like the Extropians who see technology as the stairway to a higher plane. (See "Meet the Extropians," *Wired* 2.10, page 102.)

"All this suggests that you don't have to be a religious fanatic, a Christian fundamentalist, or a ufologist to believe that our world may be in trouble – that there's something serious afoot in our nation and our world," Lamy adds. "The Y2K problem is overlapping with other survivalist movements, and like them it shares a kind of a fatalistic vision of the future."

Three weeks have passed since Scott Olmsted put the carpet installers to work in his retreat. The carpet is in now, and he's turned his attention to other details, like night-vision equipment – his property is on high ground, and with the right hardware he could scan most of the valley from his backyard. He's also thinking of getting laser eye surgery so that he won't be dependent on contact lenses after 2000. It never seems to end. "Once you take the first steps to prepare, you basically admit that this is big enough to do something about. And then you realize you should be doing more."

Scott has turned his back on denial – the blind faith that allows people to live normal lives in the face of staggering complexity, risk, and uncertainty. Instead, he's chosen to acknowledge his own vulnerability. As he describes it, "I've always known that the economy is complex and that we live on the end of a long chain of ships, planes, and 18-wheelers." Scott sees how the Y2K bug could disrupt that chain, and like other resolute souls – environmental activists, antiabortion protesters, and corporate whistle-blowers to name a few – he, too, has been driven to act by the clarity and intensity of his vision. The rest of us may be content without quite so much awareness, but embracing the Bug has actually made Scott feel better. "I know one guy who started taking Prozac when his denial fell away," he says. "Taking action – doing something – really gets you out of that."

Scott admits there isn't enough evidence to prove he's right. But, he insists, that's not the way to look at it. "There's not nearly enough evidence pointing the other way to make me abandon my preparations," he says. In a way, he's managed to optimize the Y2K problem – even if the new millennium dawns without incident, his efforts will have yielded a supply of inexpensive food, a new collection of practical skills, and a nice vacation home in the country. It's an eminently logical win-win, and Scott has taken comfort in that. "I'm not waiting until the ground is shaking to prepare for the Y2K earthquake," he muses. "I'm going to be ready for an 8.5. I may look foolish if it turns out to be minor, but that's OK. That's the nature of decisionmaking under uncertainty." ■ ■ ■

One Huge Computer

◀ 133 programmers call transactions, which ensure that groups of commands sent out over the network actually occur as a unit. A variety of programmers had worked out leasing, a framework for short-term relations between objects. Bob Scheifler, a leader of the X Consortium – an industrywide initiative to build cross-platform interface technology – had the network-security know-how. “Two coffees into breakfast,” recalls Joy, Jini was in high gear.

Reality check

You have to drill down energetically into Microsoft’s sprawling Web site, but there it is, in the list of projects under way at Microsoft Research. “We believe it is time to reexamine the operating system’s role in computing,” reads the opening line of a proposal for an initiative dubbed Millennium, described as “a new self-organizing, self-tuning distributed system.” NT’s 20 million-odd lines of code notwithstanding, Millennium envisions “a distributed operating system, based on a few principles pervasively applied.” As part of that system, “any code fragment might run anywhere, any data object might live anywhere.”

Sound familiar? It would also be “self-configuring, self-monitoring, and self-tuning. And of course, it would be scalable and secure.” Of course.

In the long tradition of Microsoft vaporware, there may be less to Millennium than meets the eye – the team consists of a half-dozen full-time researchers, according to a spokesperson, and a couple of active prototypes. One working system, dubbed Coign, distributes conventionally written applications on the fly; the other, Borg, creates a distributed version of the Java Virtual Machine. Microsoft famously got jumped once before by a technology, the Internet, that didn’t quite fit Redmond’s worldview; despite all of his current distractions, Bill Gates doesn’t want to get paradigm-shifted once again. Whatever Millennium turns out to be – vaporware stalking-horse or shrewdly hedged bet – the Kremlin of centrally planned computing has more reasons than most to be paying attention to new rumblings on the network.

And there’s not just Bill Joy and Sun to worry about. Add to the list Lucent’s ever about-to-take-off Inferno; an ambitious Caltech project called Infospheres; even Larry Ellison’s half-baked network computer scheme – all are pursuing the distributed-computing dream. Even sleepy AT&T this spring unveiled a Java-based “enhanced net-

work infrastructure” called GeoPlex, designed to let telecom companies offer services across the whole array of digital devices and networks. Apparently you don’t need to be a software hero with a private Aspen research lab and 20/20 programming vision to detect a potential revolution.

So ... why Jini?

The short answer, of course, is Java, whose slipstream – a million active programmers, by Sun’s latest reckoning – can give Jini the kind of instant presence and easy learning curve Java got from Netscape and C++. A quiet argument is under way in Jini’s marketing team over how closely to stick to Java branding; the leading contender has been JavaTone, as in the universal telephone signal.

But Jini is primed to ride a potentially even more powerful new wave: hardware geared for the network. Jini’s main beta testers are not the usual Silicon Valley coders – licensees already signed up include a dream team of big-time hardware players who seem to be falling over each other with raves. “Anyone who’s ever tried adding storage on a LAN can tell you why we need this,” says Paul Borrill, vice president and chief architect at Quantum, the disk drive maker. “To use an overused phrase, this is a paradigm shift.” Quantum expects to ship its first Jini-ized devices late next

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year. Billy Moon, Ericsson's New Concepts program director, goes one shift better: "It's a double-barreled paradigm shift that reaches beyond the computer industry. The combination of componentized software running on distributed virtual machines and the bold system architecture transform and blur the very idea of what computers, networks, and applications are."

Things get vaguer when the question turns to the new services that Jini could spawn. Plug-and-play is a nice feature. Exploding the computer back to its components – storage and processing especially – is a potential revolution, opening the door to everything from supercomputing on demand to massively encrypted remote data storage and your own personal desktop available on any machine in the world. Clever corporate marketers and ecommerce entrepreneurs presumably will sort these offerings out.

Jini avoids one common stumbling block of many clean-slate solutions: incompatibility. Specialized programming languages, legacy applications, and hardware all do fine under a Jini régime; the only requirement, beyond being Java-enabled, is that they observe the basic networking rules. "The whole idea is to be very forgiving," Joy says. "If you have slightly different code than I do, that's

fine – when I get one of your objects, I also get the code that goes along with it. We don't have to agree beyond the basic rules, and we can let the best – the most functional, fastest, easiest – code win. So you can keep your Windows if you want it. But now the network will be evolutionary – the survival of the fittest."

But of course, "fittest" in technology does not always mean "best" – hello, Macintosh and Beta-max. On the Net and in court, Sun is already battling competing Java "flavors" – variations of the language – launched from Redmond. In May, Sun filed a suit against Microsoft to try to rein in its licensees and enforce "100 Percent Pure Java." But the fight has at least given Jini's creators the benefit of hindsight. And the sidestep they came up with plays directly to the strength of a distributed system: When Jini tries to run on a nonstandard Java Virtual Machine, Jini automatically queries its capabilities, then uploads whatever chunks of code are needed to make it fully compatible. "You could design a system to prohibit that," says Clary, the Jini project manager. "But that would violate the licensing terms a lot more flagrantly than just leaving some features out. There'd be nothing gray-area about it. And it's hard to see the value in deliberately shutting yourself off from the world."

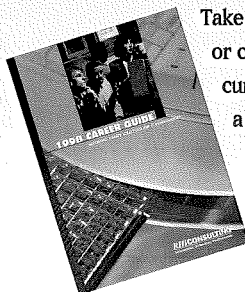
Sun has also been working overtime to address what remains the favorite bugaboo of Java skeptics: speed, as in lack thereof. Java's "sluggishness" is a favorite complaint of Net surfers watching Web applets – Java's most visible face – slowly unfurl. The seriousness of the problem has attracted a correspondingly high amount of programmer energy. As one result, a new generation of just-in-time compilers is emerging for a variety of operating platforms, produced both by Sun itself and by third-party developers. And later this year, Sun will release the 1.2 version of Java, one of whose new features, HotSpot, is dynamic optimization, which Sun officials claim can take JIT compilation to "C-level performance."

Will Jini scale out to the size of, say, the planet? "We've looked at this every way we can think of," says Clary. "And the answer is yes." Object-based programming makes sense for the same reason that packet-switching is now the technology of choice for networks: It reduces huge problems to small pieces. That in turn points inevitably to a move from today's mostly client/server networking to peer-to-peer relations, with code and data flying in all directions across the network. And the resulting complexity, the Jini team concluded, could be dealt with only by stripping its basic 170 ►

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One Huge Computer

◀ 169 operating rules to an absolute minimum. "How do we know whether we made the right choices?" says Waldo. "You never know. We stopped only when we couldn't throw things out anymore."

When Joy and Clary took Jini to Sun CEO Scott McNealy for a green light in March of last year, they used the phrase "opportunity driven" – Valley-speak for a project that will build its market on the fly. As with Java, the benefits to Sun are a subject for debate – possibly, Jini-configured hardware; more certainly, an inside track on what could well be historic technological changes. What everyone agrees is that timing will determine Jini's fate. "It's like that portal opening in *Star Trek*," Joy says. "If you're lucky, you get through the opening, and then the portal closes."

Comes the comet

In 1979, Steve Jobs – then an unknown 23-year-old geek – made his now-legendary visit to Xerox PARC to see the radical new Alto computer, with its primitive mouse and icon-based screen. "I saw a very rudimentary graphical interface," he said years later (see "Steve Jobs: The Next Insanely Great Thing," *Wired* 4.02, page 102). "It wasn't

complete. It wasn't right. But within 10 minutes it was obvious that every computer in the world would work this way someday." Two years ago, Jobs made the same prediction about object-based distributed computing. "You can argue about how many years it will take," he said, "and who the winners and losers will be during this transition. But you can't argue about the inevitability."

WebObjects, Jobs's project in pursuit of that vision, never took off in part because its success depended on a wholesale switch to a new hardware platform, the ill-fated NeXT. Not an especially good strategy for an undertaking with universal aspirations.

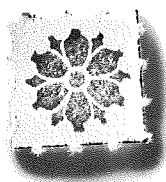
But, as Jobs predicted, one way or another it will happen – indeed, it is happening, before our very eyes. The Web is growing in every dimension – faster, bigger, deeper and more sophisticated by the day. Intelligence is being embedded in everything. Ever larger chunks of human activity are migrating to the network. And that greater genie surely will not be going back into any bottle.

Joy's Jini, if it takes hold, has the potential to overturn the familiar territory of hardware, personal computers, peripherals, phones, TVs, and appliances. The vision of what comes after is just that – a vision. For people like Bill Joy, it hovers

like a city on a hill, elegant and platonic, waiting for us humans to make it so. But the closer it gets, the easier it will be for everyone to see. "Imagine a global network so complex it will be a kind of organism, a dynamic, richly interconnected medium wrapped around the earth 24,000 miles deep." That's not Teilhard de Chardin – it's the 1997 annual report from Daimler-Benz North America.

For now, though, some old lines are still drawn: central planning versus competition. NT's 20 million lines of code versus the 600 Kbytes of Jini. Bill versus Bill. Redmond versus Aspen – there's a pattern working here, and it almost surely has as much to do with philosophy or faith as it does with questions of mere technology.

For its part, Jini is gambling that a small nudge can actually relocate a mountain. "Our goal is to lose control over the network," says Jim Waldo, "and make everyone else – from Bell Labs to Redmond – lose control too." He's not talking about market share, not by itself anyway. "What we're trying to build are the mammals to compete with the big computational dinosaurs. You can imagine how the conversation went: 'They're too small. They're nothing – they're not enterprise scaled.' But the comet is coming. And when it does, we know who inherits the earth." ■ ■ ■



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Joy Shtick

◀ 131 The common programming languages of C and C++ basically beached us. These languages are like whales. Sun and Microsoft maintain these monstrous C programs – Solaris and Windows NT – that are built out of materials that are very difficult to work with. Windows NT 4.0 is 16.5 million lines of code that will never be debugged. It is infinitely complex. It is like having an elephant living in your apartment. The thing is just monstrous. NT for consumers is an oxymoron because NT is basically mainframe software with all these windows and very little architecture. It is a mess.

Yet NT is a hit. Everyone is moving on to it. Many people were happy with the cars they bought from Detroit before Honda came along. I'd like to think that Java is more like when the Japanese came along with quality cars. With Java-based programming, instead of having one big system with infinitely complex buggy software, we can get a federation of machines working together to solve problems. The individual components are simpler.

But why bother when there are other, less radical options in the marketplace already?

Yeah, but those options are no better than what we had 15 years ago. Windows 98 is basically the same architecture that the Mac had in 1984. In a world of millions of devices, what you want to be able to do is send new bits of code and have them interlink. Ideally, the code would have flexible linkage – flexible linkage is, in fact, the hardest bit of the job. C and all the programs related to it don't solve the programming problems of

We've been getting a free ride with Moore's Law – the machines just get faster and cover our tracks.

this world. They did not anticipate a world of millions of devices.

And you feel Java does?

Yes. Java is state of the art. I don't know how to do better. We have in mind that all these things – bolts, shirts, watches, smart cards, rings, physics, chemistry, instructions – all of this knowledge can get represented as components. I think Unix is a great system – especially for running data centers – because it is very mature, very reliable, very scalable. But when I want to go out and populate small devices, I think Java. That is why

Windows Everywhere is such a flawed idea. You don't want the same user interface on a small device as on a desktop. They can't both be right.

Can you give me your version of what Java is? Java makes it easy for more people to write smaller programs that can be combined to make larger pieces. Think of it as letting you do Lego software. It has a network effect. Something like

Windows or the Mac or even Unix doesn't really have a network effect. They have pieces of code that must grow linearly into one big mess.

Let's be realistic. NT is pretty locked in right now. Technology is still moving along fast enough that there are opportunities for lock-ins to be broken. It's still possible. Also, being first is risky. It's best to be second. It's difficult to be first because you make the commitments too early and you typically get stuck in the wrong standards. It's better to be Yahoo! than Netscape.

When is Java going to get locked in?

182 ▶

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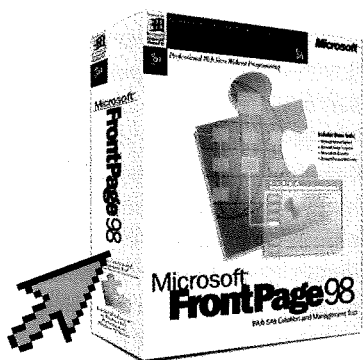
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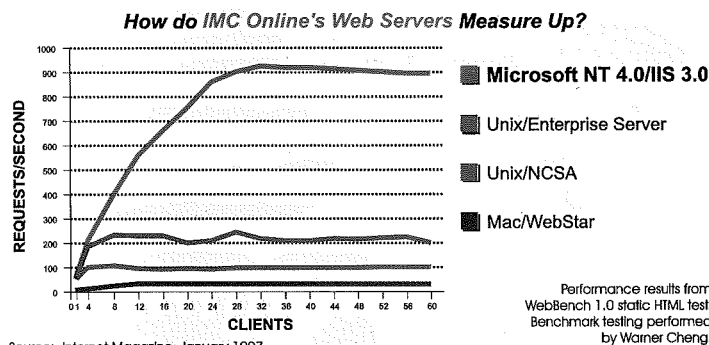
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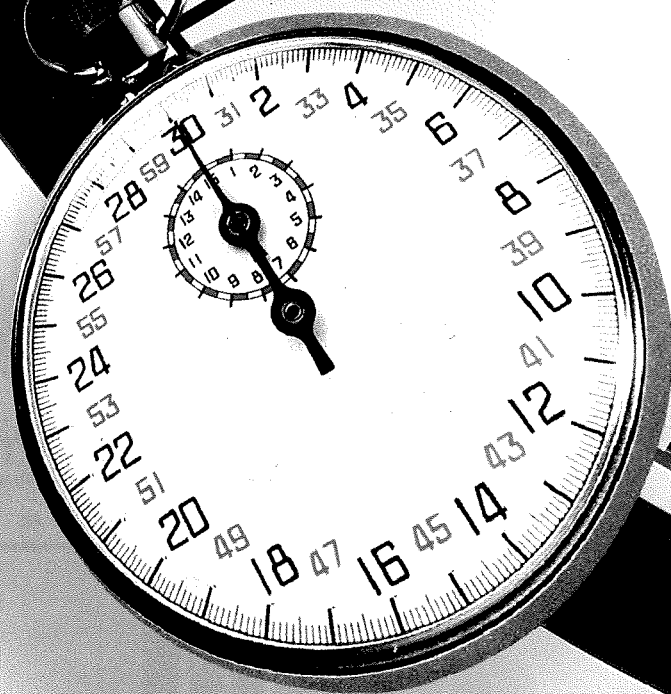
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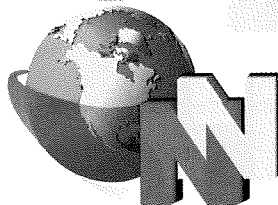
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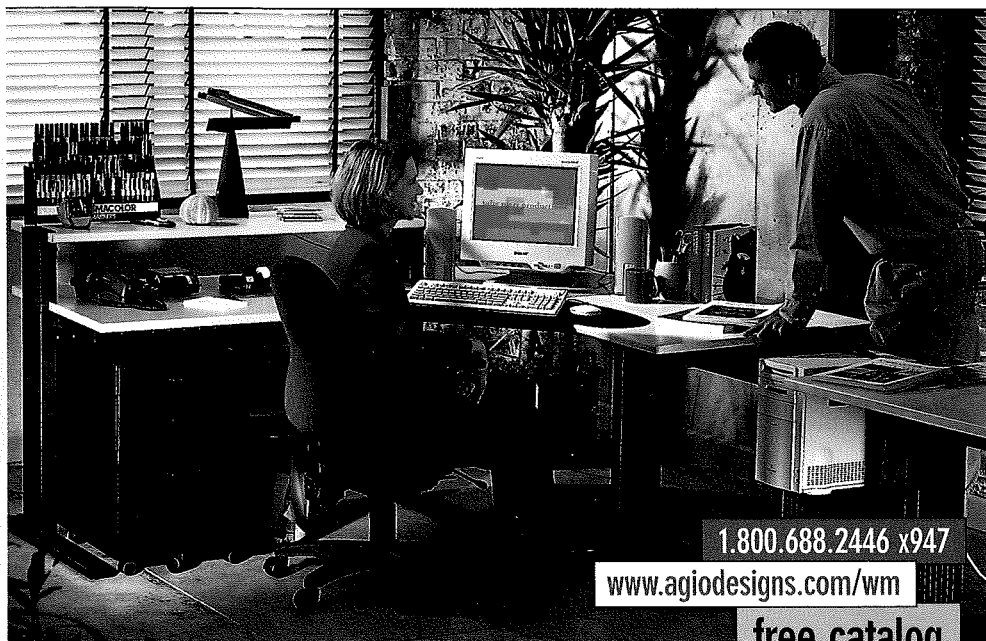


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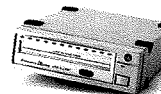
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Joy Shtick

◀ 171 We're in a tool-building phase. Once we have enough tools, things will happen very quickly.

Microsoft is now into components. It's developing new tools that help string Visual Basic components together, making software that automates the job.

If you're Microsoft, that's what you do. Why is that approach not as good? Because the language will forever be test-free. You can't check the software. But with Java you can.

Microsoft has its own distributed architecture project going, called Millennium. Are you impressed? Any program that is written by hundreds of programmers will inherently be too hard for most people to understand. It just has too many features. It is going to be so complicated. They are trying to make an operating system that gives you an infinite number of choices, that anticipates everything you might want to do.

Funny thing is, the marketplace tends to run ahead of understanding – it deploys things before we understand how they work.

Is that their problem?

They are trying to plan the whole world. For our own good. But we are better off being a little more decentralized and a little less complicated. Do you think making code open, or even free, is the way to shift allegiances in your favor? The Open Source theorem says that if you give away source code, innovation will occur. Certainly, Unix was done this way. With Netscape and Linux we've seen this phenomenon become even bigger. However, the corollary states that the innovation will occur elsewhere. No matter how many people you hire. So the only way to get close to the state of the art is to give the people who are going to be doing the innovative things the means to do it. That's why we had built-in source code with Unix. Open source is tapping the energy that's out there. Netscape says customers fix the bugs faster than it can.

Of course, the question with open source is how you make a profit. How will Sun make money on all this, five or ten years down the road?

We'll make money from platform royalties. We'll make money from some applications. I think we'll make money from drag-through sales of devices.

What is the problem that Jini is trying to solve?

If you have two programs talking to each other, even the simplest incompatibility is really inconvenient. If I have a different floating-point number format than you do, and I send you a floating-point number, it might be a number here and it might be an infinity over there.

Don't architectures like Corba and IPC address those issues?

They don't really solve them, because in the end, the programs don't communicate at the level where I can take an object and give you an object. If you already have an object, they can tell you to use it. But, they can't send you an object and they can't send you the code. They can only send you the name. And there is a huge difference between being able to send you a program that you can run or a piece of program that you can run, and being limited to the repertoire of what you already have.

Jini employs something you call JavaSpace. Can you explain that?

JavaSpace is just the idea of a space where a device can "read," "write," or "take." I'd say it is like the co-op bulletin board. You go in the door and there are all these pieces of paper: You have that, I want this. Some of them have little strips along the bottom; you can take a phone number. You can make a copy of it without removing it or you can just take the whole piece of paper or you can stick one up. It's transactive. Today, transactions only come in the context of these funky database systems that are huge. If you want to do a transaction, even for something as simple as a purchase, you have to crank up an Oracle database. With JavaSpaces, you have simple transactive communication.

Is there a simple way to describe how Jini actually works?

Jini provides what you can think of as a "Java-Tone," the equivalent of what happens when you pick up a telephone. The services it links to can be hardware – a disk drive, for instance, for storing things. Or it can be software – any consumer service you can think of. If you're providing a service, you don't have to be a Java Virtual Machine – you can be a light switch, or a legacy

mainframe. What we call a "lookup service" goes out and finds the service – or the users – you want, and you get back a Java object, which you reconstitute after downloading the appropriate code.

Where are you headed next?

I'm very interested in agent systems. A lot of people in computer science are looking at the theoretical properties of agent systems. But the funny thing is, the marketplace tends to run ahead of understanding. It tends to try to deploy things before we completely understand how they work. Take the work that General Magic did. They postulated a new family of agent-based devices and tried to make them commercial. For whatever reason, that didn't work, but I'm not sure people have worked out either the social or technical properties of agents. This summer I want to research what other people think about agents, both commercially and in research.

So what is your methodology?

I'll probably go to Yahoo! and HotBot and type in "agents" and see what I get. I'm searching for a breakpoint in the technology. A dislocation. A conceptual breakthrough. It is really hard to say. I don't even know what problem I am trying to solve.

How will you discover the right problem?

I'm opportunity-driven. It seems that there is an opportunity with mobile code, since we haven't had mobile code and now we do. Once, we didn't have batteries and now we do. Once, we didn't have fractional-horsepower motors and now we do. Now that we have mobile code, let's figure out some things we can do with it.

So you're courting the killer opp.

I like to work on interesting things and push the rock a little bit of the way up the hill. And I like time warps, because they can give us a vision of the future. But they are expensive.

What does that mean?

In the 1970s, Xerox PARC built all the researchers in the lab a 42-mips personal computer. The computers were so noisy that first they built this cone-of-silence device around each one – they called it the armored personnel carrier. They eventually had to put them all in a separate room. But by spending \$50,000 or whatever per person, they built a time warp and they got to see the future. That's what we did with the wireless network in Aspen. That's what Jini is.

Isn't that a bit idealistic?

Sometimes the easiest way to get something done is to be a little naïve about it – and just ship it.

■ ■ ■

Colophon

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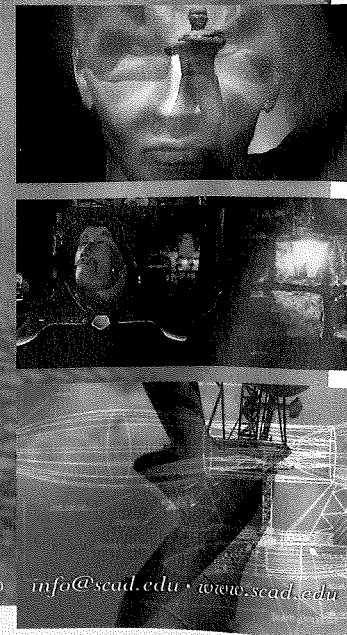
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Contrainuitive

I finally switched to Wintel. And what angers me most about the move is that Apple forced me into it.

One compelling reason for the change: With the Macintosh's shrinking market share, no start-up or single entrepreneur can feel confident basing his or her work on the Mac; even kids shy away from it, preferring what many children insist are more "serious machines." Another reason, well emphasized by the press, is the low and decreasing number of old third-party developers, and the utter absence of new ones. Yet another reason: Mac software and peripherals are far too few in number; even worse, when they do appear, it's much later than the competition. People concerned about tomorrow just cannot settle for the tools of yesterday. Finally, and unfortunately for Apple, its last-ditch efforts to leap back on the leading edge – the G3-based Power Mac and PowerBook; the iMac, "the Internet-age" computer for the

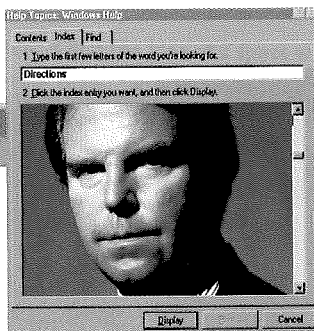
seasoned skier. But after two or three days, your balance overcomes the "unnatural" counterintuitive moves you must make.

By contrast, after six months I am still falling all over the slopes of Windows, in total disbelief at the collective complexity and unbelievable inconsistencies introduced by all parties involved. This is an indictment of not just Microsoft, but the entire community of software and hardware developers who have done such a bad job of making usable and explainable systems – so much so that I'm convinced, in dark moments, that some of this is purposeful.

A slightly more charitable view follows.

Windows as ugly reality

First impressions die hard. In fact, the initial shock of seeing something



completely strange and new sometimes

outlasts the relationship. In the world of humans, the cause can be something as minor as crooked teeth or as major as missing limbs. It can also be self-imposed body modification, which might include hair color, nose rings, or tattoos. In any case, the impact wears off eventually. The better and better you get to know the person, the more you see through the malformation of first impression. Ultimately, the unsightliness disappears almost totally in favor of the person's mind and personality.

So far, that has not happened with my new friend Windows.

Windows as a city

Driving in a city for the first time, you are completely dependent on road signs. And far too often the most important one is behind a fully blossomed tree, is unlit at night, has changed names without notice, or uses nomenclature that is understandable only if you know the city. If you are a resident, of course, you never notice these inconsistencies, because you don't use signs to navigate. You already know where you are, where you're going, and how to get there.

Though some cities try to use universally recognized, "intuitive" road signs, the city of Windows certainly needs to be much more friendly to nonresidents. System designers take note: It is time to test-drive your grandmothers.

Past the age of innocence

As a professor and lab director, my job includes forgiving all sorts of defects and omissions in favor of encouraging the positive elements of new ideas and their imaginative demonstration. Frequently the very innocence of the application design is part of its beauty. Nonetheless, the sad truth is that a great demo at the Media Lab is often refined to death, thanks to the natural human instinct of falling in love with your creation, refusing to let go, and wanting to make it better and better, à la Pygmalion.

Almost without exception, however, the most recent release of any software product is slightly worse than what it's replacing. This is true on the Mac as well. Take a deep breath and repeat after me: Leave it alone. Well-intentioned ameliorations have turned elegant solutions into bloated programs, the "upgrade" often being that you can do almost the same thing in five or more different ways, with inconsistent results. The user is second-guessed so much nowadays that a simple typo can set your computer into disastrous motion.

Each time I try to position my cursor in Word, I enter into an argument about what I mean – it is so clever! Yet something as basic (to Mac users) as click versus doubleclick is not handled consistently. Puh-leazze.

On the other hand, surely it is possible for software designers, in and outside Microsoft, to not confuse new users by representing different actions the same way. Why, for example, does the standard upper-right-hand X-box close the document when clicked on the window but shut down the entire program when clicked on the application bar? Within one company, even a big one, there should be clearer signals – and symbols.

But it is purposeful, dummy

Thus *contrainuitive*, not counterintuitive. Every software company has a Department of Guaranteed Revisions, real or fictitious, assigned the all-important mission of securing future sales. This doesn't mean updates and bug fixes – which ought to, but don't necessarily, come free. It means new features. Therein lies the problem.

Looked at one by one, these new features may have some merit to some people. But as they grow in number, a simple boxwood hedge starts looking like a jungle of poison ivy.

In an effort to hack through it all, I installed AltaVista to search my disk drive. Alas, it cannot open most of the files, and it sends me through four painful hunt-and-clicks to finally choose one out of 53 programs to open the file. This army of "viewers" is presented through a tiny window that allows you to see no more than seven items at once, as you scroll, in my case, to WordPad, the bottom of the list.

At least it works half the time. Still, if there is anything that a computer should know better than me, it is how to open a file. I guess that is the next release. ■ ■ ■

Next: Rural One-Room Schools

First impressions generally wear off as a relationship matures. This hasn't happened with my new friend Windows.

rest of us" – are far too late, if not too little. "Pro, Go, Whoa"? No. I already think different.

So, sadly, I switch away from a system that I used for almost 15 years, at least three hours a day, seven days a week, without ever once in all those years having read or even opened a manual.

The nightmare begins.

Windows as a snowboard

Learning to snowboard is considerably harder if you know how to ski; in fact, the first day requires enormous humility from the otherwise

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